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Vol. XXXII No. 3 MARCH 1961

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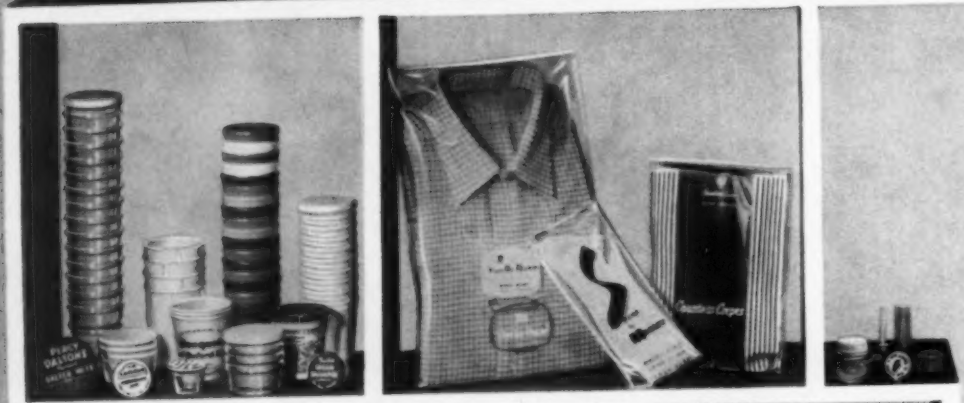

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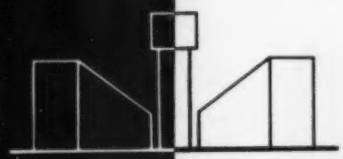

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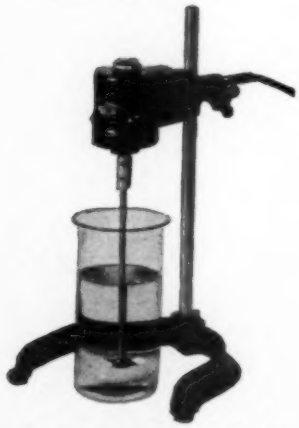

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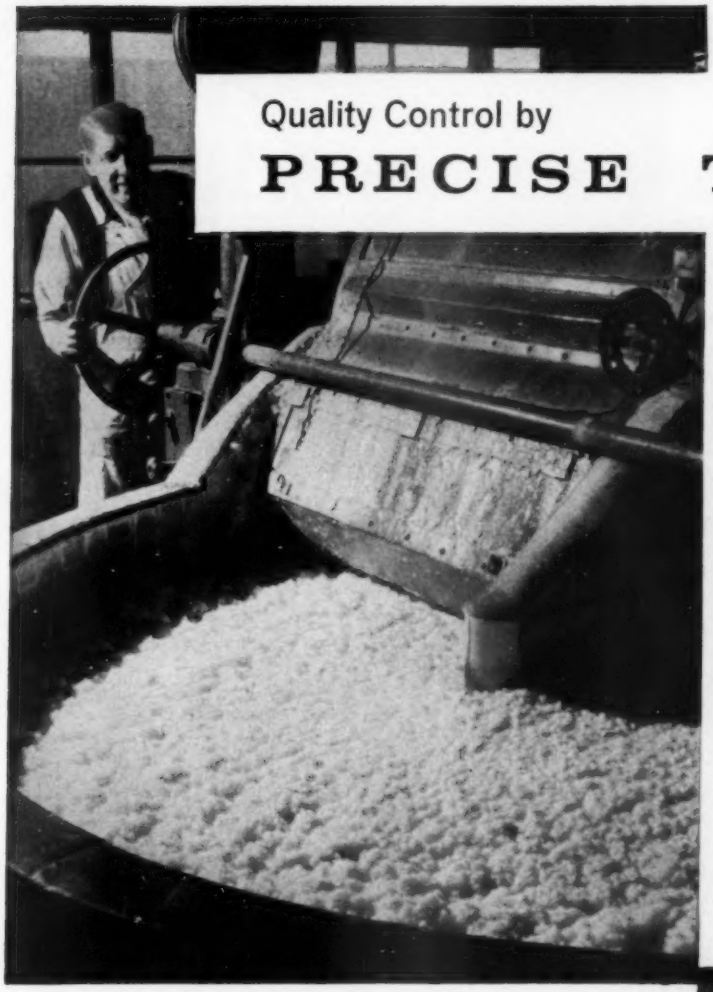

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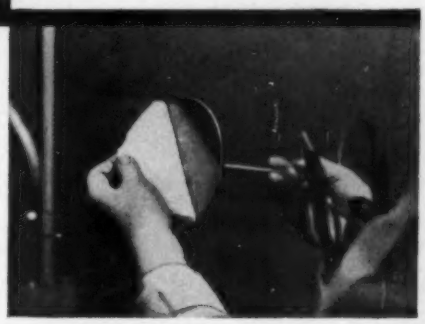

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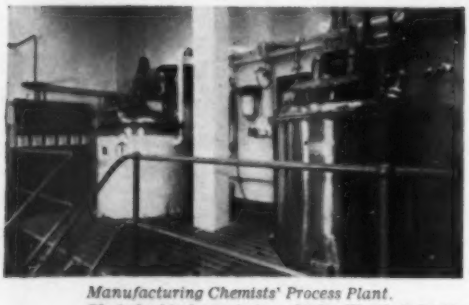

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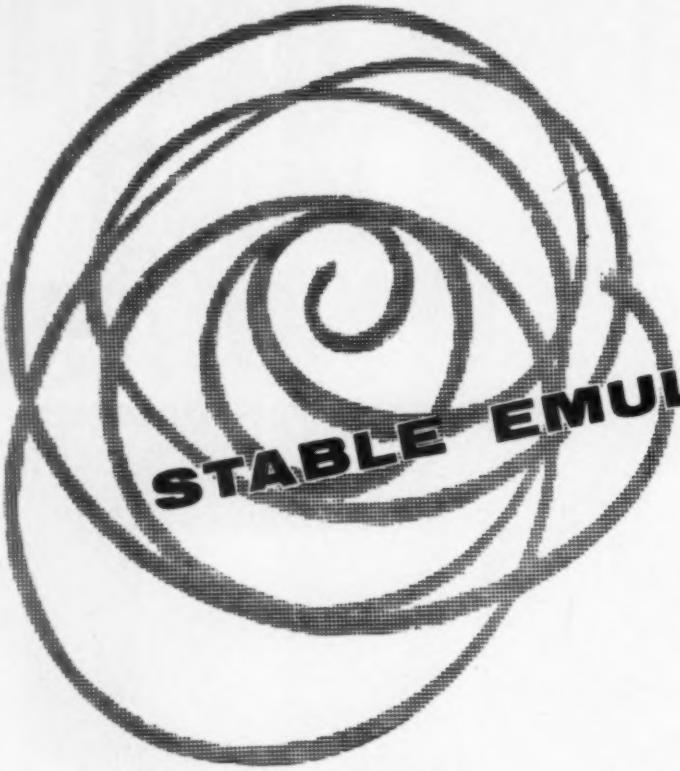

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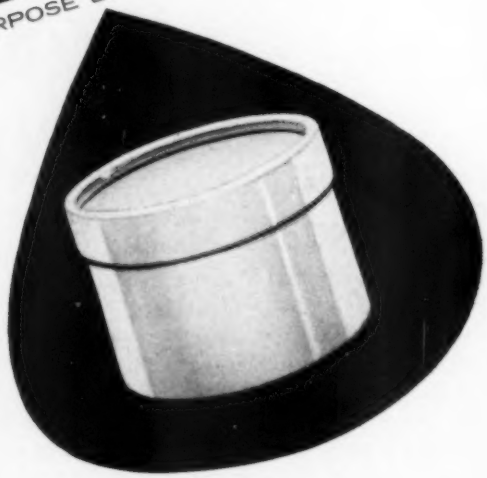

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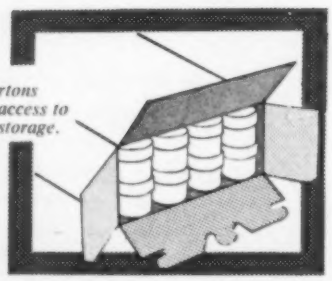

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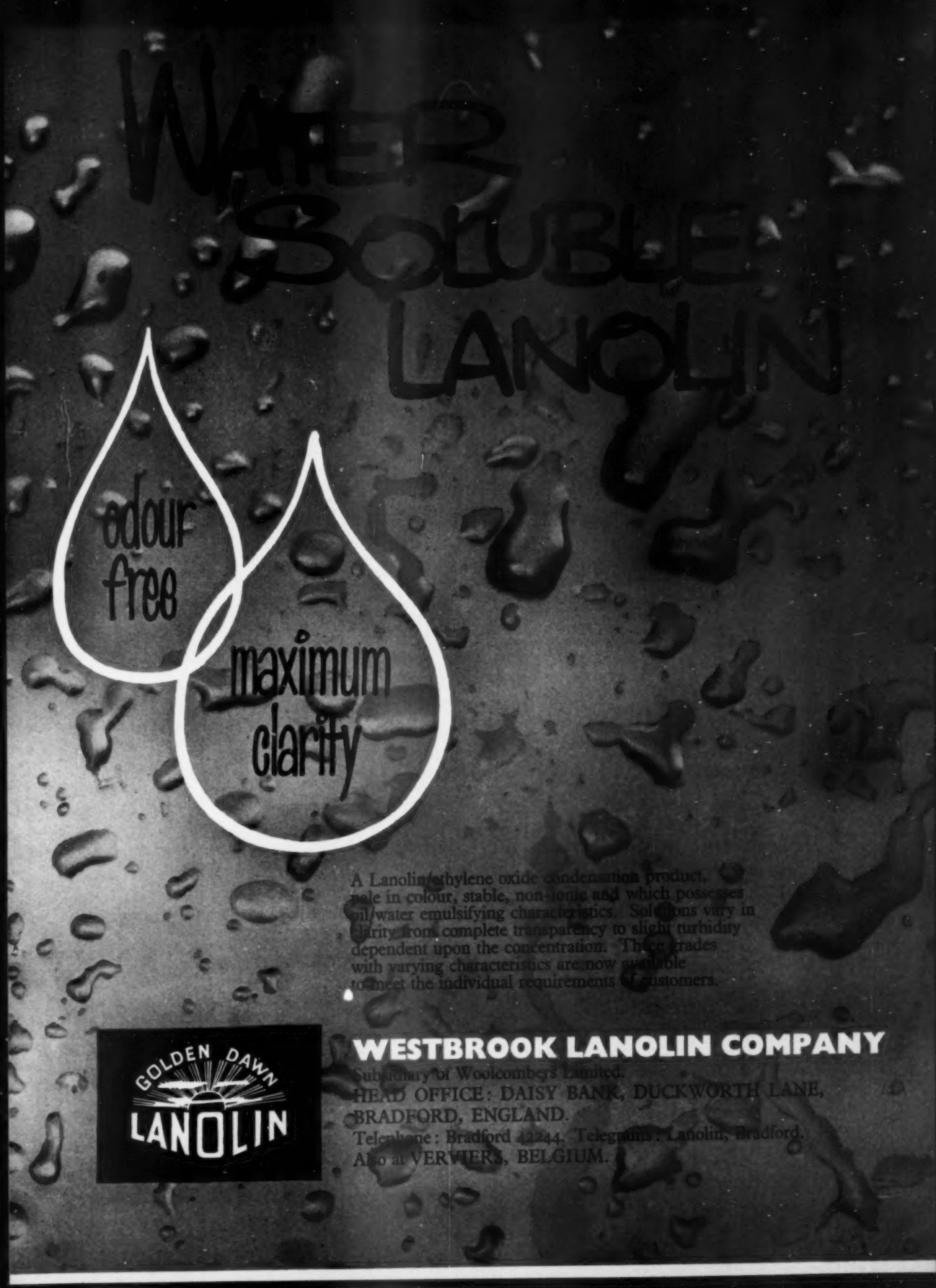
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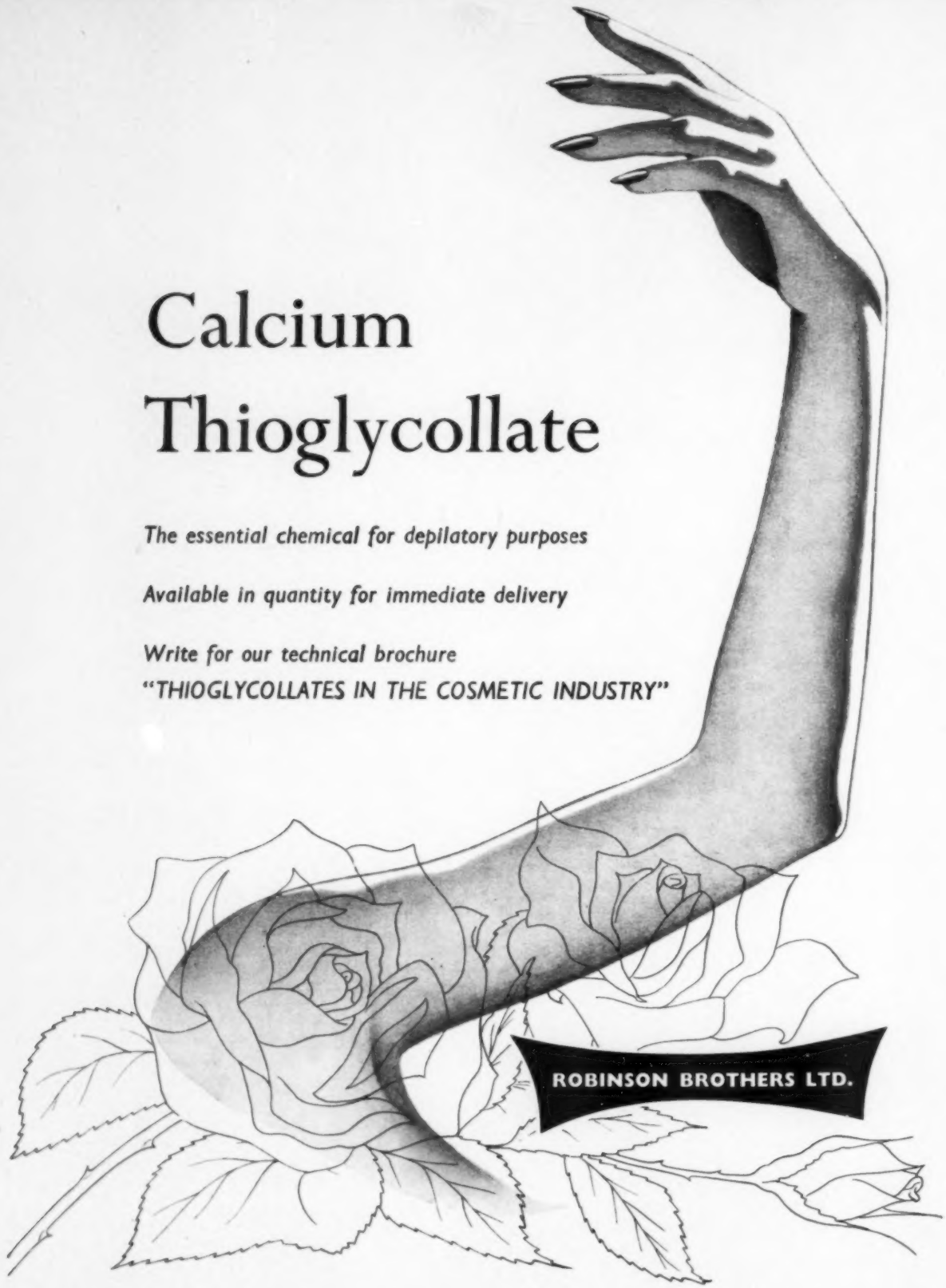

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PEARLINE SERIES

Regd. No. 889126

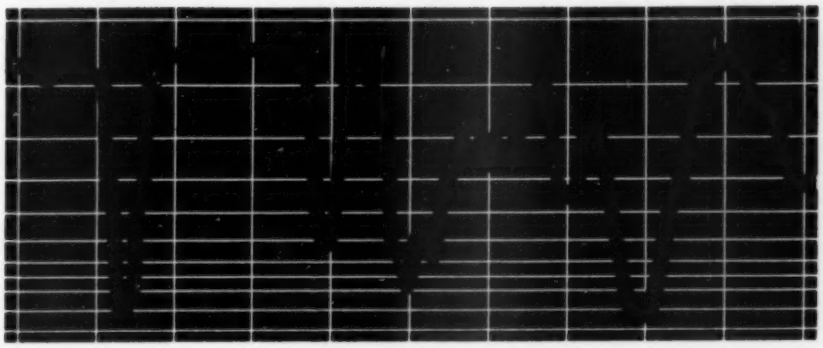
This new design is being made in
2 and 4 oz capacities.
Samples available on request.

THE INTERNATIONAL BOTTLE CO. LTD.

140, PARK LANE, LONDON, W.1.

Telephone MAYfair 6992 (5 lines) *Telegrams Autrefois, Audley, London.*

The Molecule's Fingerprint



In criminology a fingerprint is regarded as an infallible characteristic of the individual. In chemical analysis a substance is characterized just as unmistakably by its spectrum. The use of spectroscopy as a modern means of investigation serves as a check on manufacturing and thus guarantees consistency in quality. Spectroscopy has in addition become an indispensable adjuvant in our physico-chemical research laboratories for the purpose of research and development.

We have published a booklet entitled "Absorption Spectroscopy", and shall be pleased to place it at the disposal of interested parties upon request.

DRAGOCO
HOLZMINDEN

Sole agents in U.K.:
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Phone: Mansion House 35 86

MEDICALS

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RECTANGULAR TABLETS

VIALS

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EMERALD POISONS

DROPPERS

EMULSIONS

JARS

PANELS

OLIVE OILS

TOILETS

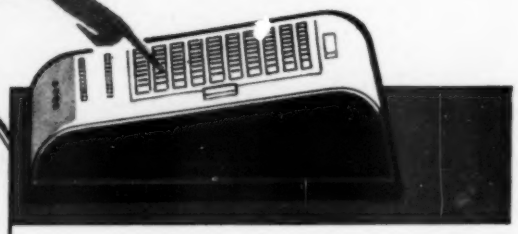
PLAIN WINCHESTERS

POISON WINCHESTERS

POWDERS

Miss Beatson's

VITAL STATISTICS



A few facts about Beatson, Clark which you may care to think over when you next order bottles:

210 years' experience of glass manufacture.

Hundreds of standard lines stocked.

Millions of containers made each week.

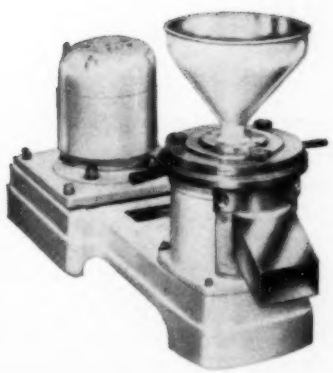
Bottles for busy chemists...

BEATSON

BEATSON, CLARK & CO. LTD.
Glass Bottle Manufacturers since 1751
ROTHERHAM · YORKSHIRE · Telephone: Rotherham 3188

MB 2

Keep it under your hat!



Are your competitors using a Premier 3" Multipurpose Mill? If so, it has solved their dispersion, emulsification and fine grinding problems. No wonder they're keeping quiet about it! Small manufacturers or large organisations–all who are concerned with the economical handling of small batches–find it gives results identical to those obtained on larger equipment.

Taking up only three square feet of bench space, this unit disperses, fine grinds and emulsifies at the rate of 5 to 50 gallons an hour. There is absolutely no wastage whether the amount processed is a pound or a ton. The Mill involves little capital outlay and maintenance is negligible since it cleans as easily as a saucepan.

We will gladly arrange a demonstration with your own raw materials in our modern laboratories at Hersham or Leeds. And we promise to keep the results—amazing as they will certainly be—strictly under *our* hat!

Write or 'phone for detailed information to:

PREMIER COLLOID MILLS LIMITED

PREMIER COLLOID MILLS LTD

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TELEPHONE: WALTON 26305

CLOSURE by KORK-N-SEAL

for Meltonian Wren Limited

Kork-N-Seal make a wider variety of closures than any other British manufacturer, for glass, metal and plastic containers. They are part of United Glass Ltd., Britain's leading makers of glass containers, so your closures and glass containers can be produced and delivered together.

If you need closures, or expert advice on closures, come to Kork-N-Seal. You'll get the best service there is. Please write or 'phone.

KORK-N-SEAL

The Closure Division of United Glass Limited

KORK-N-SEAL LIMITED
Leicester House, Leicester Square, London, W.C.2.
Phone: GERrard 8611. *Grams:* Korkanseal, Lesquare, London

PYRETHRUM EXTRACTS

PYSECT

Super Decolorised Pyrethrum extract for the fastest knock-down

- 25% by weight of total pyrethrins
- 99.5% of colour removed
- completely soluble in deodorised kerosene
- completely soluble in usual aerosol propellants
- very high stability
- colourless and will not stain

Also PYRACTONE

Super Decolorised Pyrethrum extract with Bucarpolate synergist

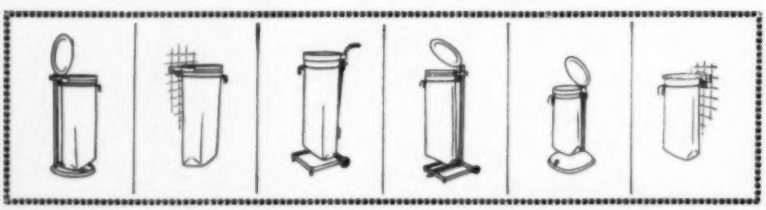
STAFFORD ALLEN & SONS LIMITED
Wharf Road, London, N.1
Telephone: CLErkenwell 1000

TAS/AL.702

give waste bins the sack

DISPOSABLE PAPER SACKS REPLACE BINS AND REVOLUTIONIZE WASTE COLLECTION

This is the modern system of waste collection. Tough, wet-strength Medway multi-wall paper sacks suspended from Cartem metal holders. When full, the sack is simply detached, closed, taken away—and a brand-new clean, fresh sack fitted. No mess. No smells. And the filled sacks are so easy to handle, too, because there's only the weight of the contents to carry—no cumbersome bin. There are places for the Medway-Cartem system everywhere. Factory shop floors. Kitchens. Surgeries. Canteens. It brings new standards of efficiency and hygiene wherever there's waste to collect. The holders come in a full size-range, mobile and static, with manual or foot-operated lid. And the sacks can be specially colour-coded for immediate identification of sack contents.
SEND FOR FULL DETAILS.



Sack-holders manufactured and supplied by Cartem Engineering Ltd., London, under Patent Number 809109

go modern with MEDWAY

Reed Packaging Division

REED MEDWAY SACKS LIMITED (DEPT.M.C.1)
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B. NEWTON MAINE LTD

Silsoe, Bedford Silsoe 296

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with emphasis on substances produced by HIGH PRESSURE HYDROGENATION

Abietic acid
Aconitine crystals
beta-Alanine
Aminoacetal
meta-Aminobenzotrifluoride
1,4-(bis-Aminomethyl)cyclohexane
9-Anthracene aldehyde
Arachyl alcohol 99%
Behenic Acid
Behenyl alcohol 90%
Behenyl alcohol 98%
Benzidine acetate
Benzyl ethyl carbinol
Benzyl iodide
Benzyl isothiocyanate
Benzyl mercaptan
Bornyl benzoate
2-Bromoheptane
3-Bromoheptane
4-Bromoheptane
p-Bromophenacyl bromide
1-Bromo-3-propanol
Butadiene sulphone
Butene-2-diol-1,4
Calcium galactonate
Calcium glucoheptonate
Calcium glycerate
Capricnitrile 99%
Caprylnitrile 99%
Carbazole (very pure)
Cephalin (ex Hog's Brain) pure
Cerium salicylate
ortho-Chlorobenzyl chloride
6-Chloro-hexanol-1
3-Chloro-propanol-1
2-Chloro-pyridine
Colchicine USP XIV
Copper guaiacol sulphonate
Cupric dibenzene sulphonate hexahydrate
Cyclodecanone semicarbazone
Cyclododecane
Cyclododecanol
Cycloheptane
Cycloheptanol
Cycloheptanone
Cycloheptylamine
Cyclohexane-1,4-biscarbinol
Cyclohexyl urea
Cyclooctanol
Cyclooctanone
Cyclooctanone isoxime
Cyclooctylamine
Cyclopentyl urea
Cyclopentylamine
Decahydrocinnamic aldehyde
Decahydro-beta-naphthyl acetate
beta-Decalol (cis trans mixed)
Decamethylene-1,10-dicarboxylic acid
Decamethylenedinitrile
n-Decane 99% (Olefin free)
Decanediol-1,10
1-Decene 95%
n-Decylamine 99%
Diaminodecane-1,10
Diaminododecane-1,12
Diaminoheptane-1,7
Diaminononane-1,9
Diaminooctane-1,8
Diaminoundecane-1,11
1,4-Dibromobutene-2
Dibromodecane-1,10
Dibromohexane-1,6
Dibromononane-1,9
Dibromooctane-1,8
Dibromopentane-1,5
Dichlorodecane-1,10
Dichlorohexane-1,6
2,3-Dichloro-1,4-naphthoquinone
Dichloropentane-1,5
Dicyclopentadienyliron
Dicyclopentylamine
Di-n-decylamine
Di-n-dodecylamine
Didymium salicylate
Diethanolamine salt of maleic hydrazide
asym-Diethyl ethylenediamine
Diethyl suberate
N-Diethyl amino acetonitrile
*1,5-Dihydroxy naphthalene
*2,7-Dihydroxy naphthalene
2,3-Dimercaptopropanol
2,2-Dimethyl-diaminopentane-1,5
a,a-Dimethylglutaric acid
Dimethyl-methylsuccinate
2,7-Dimethyl-2,7-octanediol
2,4-Dimethyl-3-pentanol (Di-isopropylcarbinol)
3,3-Dimethylpiperidine
2,5-Dimethylpyrrole
2,4-Dimethyl resorcinol
2,5-Dimethyltetrahydrofuran (water free
Dimethyl thapsate
Di-n-octylamine 99%
n-Docosane 95%
1-Docosene 95%
Dodecahydro-beta-naphthyl acetate
n-Dodecane 99% (Olefin free)
1-Dodecene 95%
n-Dodecylamine 99%
2,2-Diphenylethylamine-1
n-Eicosane 95%
1-Eicosene 95%
1, 2-Ethanedithiol
4-Ethoxy-3 methoxy benzaldehyde
2 Ethyl-1-butene 95%
Ethyl-4-chloro-2-methylphenoxy acetate
6-Ethyldecanol-3
(Ethyl-(3-ethyl)-heptylcarbinol)
5-Ethylheptanol-2
(Methyl-(3-ethyl)-pentylcarbinol)
2-Ethyl-1-hexene 95%
5-Ethylnonanol-2
(Methyl-(3-ethyl)-heptylcarbinol)
6-Ethyloctanol-3
(Ethyl-(3-ethyl)-pentylcarbinol
Eugenyl methyl ether
Ferric tartrate pure
Furfuryl acetate
Furoic acid 98% & 99·8%
Glyceryl-para-aminobenzoate
Heptamethylenedinitrile
2,2,4,4,6,8,8-Heptamethylnonane 95%
n-Heptane 99% (Olefin free)
n-Heptanol-2 (Methyl pentylcarbino
Heptanol-3
Heptanol-4 (Di-n-propylcarbinol)
1-Heptene 95%
n-Heptadeclamine pure
n-Heptylamine 99%
n-Hexadecane 99% (Olefin free)
1-Hexadecene 95%
n-Hexadecylamine 99%
Hexahydrobenzaldehyde
Hexahydrobenzyl alcohol
(Cyclohexane methanol)
Hexahydro-p-xylyldiamine
Hexamethylenedinitrile
Hexamethylene-imine
3-Hexamethylene-imino-propionitrile
3-Hexamethylene-imino-propylamine
n-Hexane 99% (Olefin free)
Hexanediol-1,6
Hexanediol-2,5
Hexanol-2 (Methyl-n-butylcarbinol)
Hexanol-3 (Ethyl-propylcarbinol)
1-Hexene 75%
Hexylcinnamic aldehyde
1-Hexyne
2-Hexyne
3-Hexyne
Lanthanum salicylate
Lauronitrile (n-Undecylcyanide
beta-Mercaptoethylamine HCl
Mercury acetamide
Mercuric succinimide
5-Methoxy-1-chloropentene-2
5-Methoxy-3-chloropentene-1
6-Methylcoumarin
3-Methylcyclopentanediol-1,2
3-Methylcyclopentanedione-1,2
Methyl cyclopentylamine
3-Methyl-5-ethyl-heptanediol-2,4
3-Methyl-5-ethyl-nonanediol-2,4
2-Methyl-7-ethylnonanol-4
(Isobutyl-(3-ethyl)-pentylcarbinol)
3-Methylheptane 95%
3-Methylheptanediol-2,4
3-Methylheptanol-2
(Methyl-(1-methyl)-pentylcarbinol)
3-Methylheptanol-5
2-Methylpentanediol-1,3
3-Methylpentanediol-2,4
3-Methylpentanol-2
(Methyl-(1-methyl)-propylcarbinol)
2-Methyl-1-pentene 95%
4-Methyl-2-pentene 95% (mostly trans)
Methylsuccinic acid
*3-Methyl thiophene
Methyltuberate
Myristonitrile 99% (n-Tridecylcyanide)
Nitrocyclohexane
5-Nitro-2-furfuraldehyde diacetate
5-Nitrofurfurylidene diacetate
o-Nitrophenylacetic acid m.p. 138°C
Nonamethylenedinitrile
Nonanediol-1,9
5-Nonanol (Di-butylcarbinol)
n-Nonylamine 99%
n-Nonylcyanide 99%
n-Octadecane 99% (olefin free
1-Octadecene 95%
n-Octadecylamine 99%
iso Octanoic acid
Octamethylenedinitrile
Octamethylene-imine
n-Octane 99% (Olefin free)
1-Octene 95%
2-Octene 95%
1,8-Octolactam
iso Octylamine
tri iso Octylamine
di iso Octylamine
n-Octylamine 99%
Palmitronitrile 99% (n-Pentadecylcyanide
Pentadecane (traces Tetradecane)
n-Pentadecylamine 99%
n-Pentadecylamine pure
Pentamethylenedinitrile
Pentanol-3 (Diethylcarbinol)
2-Pentyne
Phenanthrene-9-aldehyde
2-Phenylamino-pryidine
(2-Anilino-pyridine)
1-Phenylbutanol-2
beta-Phenylethyl iodide
beta-Phenylethyl isocyanate
beta-Phenylethyl isothiocyanate
Phenyl isopropyl aldehyde
3-Phenylpropylamine-1
bis gamma Phenylpropylethylamine Base
bis gamma Phenylpropylethylamine dihydrogen citrate
3-Piperidino-propionitrile
3-Piperidino-propylamine-1
Potassium creosote sulphonate
Potassium mercaptophenyl-thio-thiodiazolone
1, 3-Propanedithiol
3-Pyrrolidino-propionitrile
3-Pyrrolidino-propylamine-1
Resorcinol diethyl ether
Salicyloyl hydrazide
Salicylhydroxamic acid
Sebacyl dichloride $COCl(CH_2)_8COC$
Serotonin creatinine sulphate
Sodium dichloroacetic acid
Sodium phytate
Sphingomyelin (ex cerebro)
Stearonitrile 99% (n-Heptadecylcyanide
trans-Stilbene
Suberic acid
Terephthalaldehyde
Terpineol iodide
Terpineol saponate
Terpineol isothiocyanate
n-Tetradecane 99% (Olefin free
1-Tetradecene 95%
n-Tetradecylamine 99%
Tetrahydrofurfuryl salicylate
Tetrahydropyran
Theophylline-7-acetic acid
Thioacetamide
Thiosalicylic acid m.p. 160°C +
Triamyl citrate
Trichlorodimethylphenylcarbinol acetate rodist
Trichlorohexahydro-beta-naphthol
n-Tridecylamine 99%
Trimellitic anhydride
2,6,8-Trimethyl-4-nonanol
Tri-n-octylamine 90/95% & 99%
dl-Tryptophane pharmaceutical
L-Tyrosine
2-Undecanol (Methylnonylcarbinol
6-Undecanol (Di-amylcarbinol)
n-Undecylamine 99%
Variamine Blue Indicator

Better visual value . . .

'Clarifoil' acetate film has a smooth, brilliant surface, is highly transparent

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Rigid and vacuum formed packs in 'Clarifoil' can easily be made to give enhanced user appeal. And 'Clarifoil' protects the product, gives extra depth to its colour . . and *plenty* of extra sparkle

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Ask our Technical Advisory Service about it

Packs made and supplied by Hargill Ltd. and W. & F. Walker Ltd.

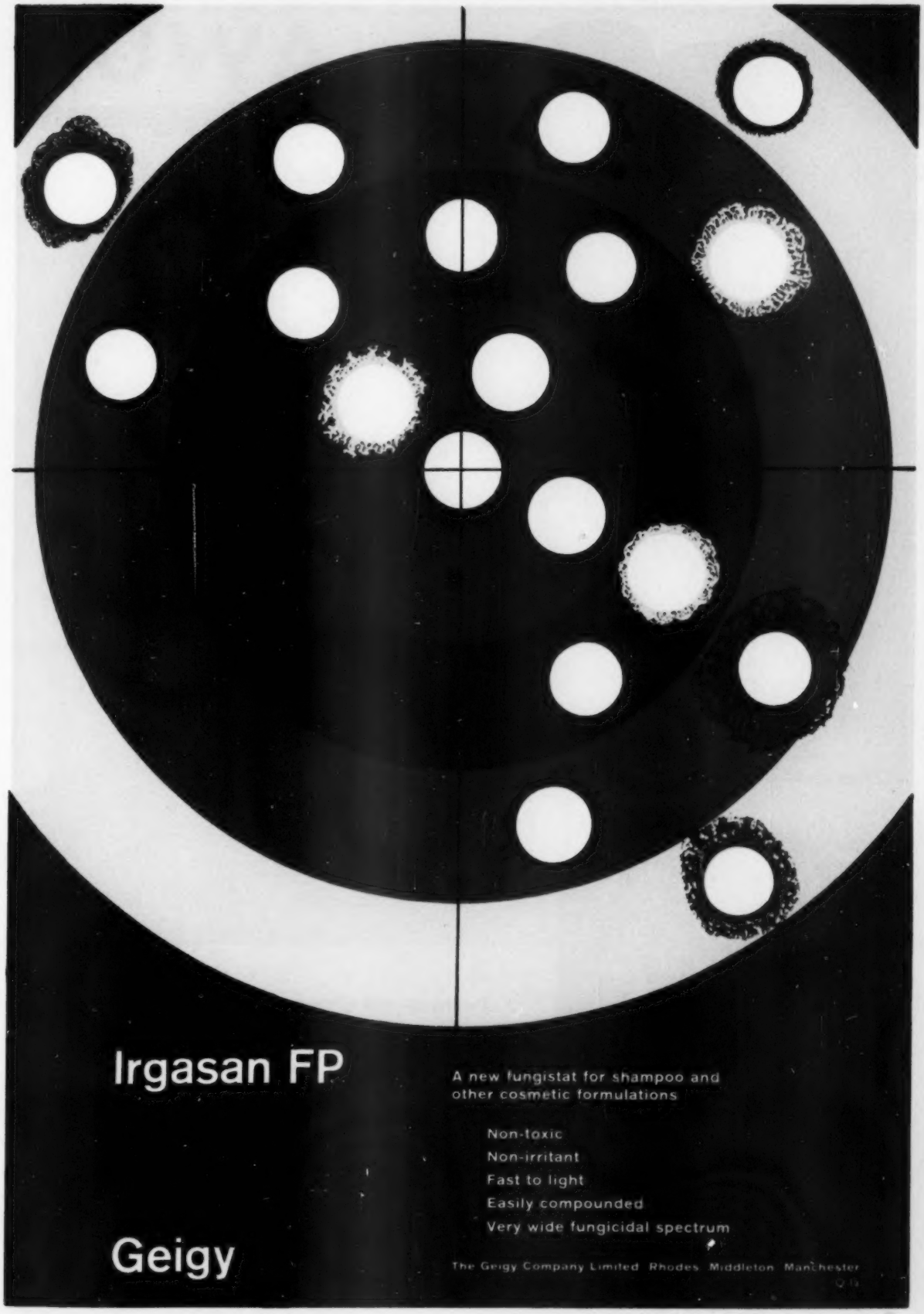
Clarifoil

TRADE MARK

TRANSPARENT ACETATE FILM

Plastics Division,
British Celanese Limited, Celanese House,
Hanover Square, London, W.1.
Telephone: Mayfair 8000

SPC-11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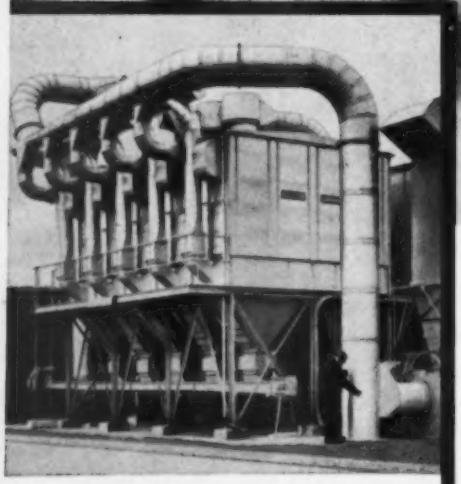
A new fungistat for shampoo and other cosmetic formulations
Non-toxic
Non-irritant
Fast to light
Easily compounded
Very wide fungicidal spectrum
Geigy
The Geigy Company Limited Rhodes Middleton Manchester

see us for dust

See Our Stand No. 3, Row BB, 1st Floor Empire Hall at the 1961 Engineering Marine, Welding and Nuclear Energy Exhibition, Olympia.



This is a Dallow Lambert Drytube
Type 3/5000 fabric sleeve dust filter handling 16,000 cfm. of dust laden air with drag link conveyor system for discharging dust into storage hopper for automatic bagging.

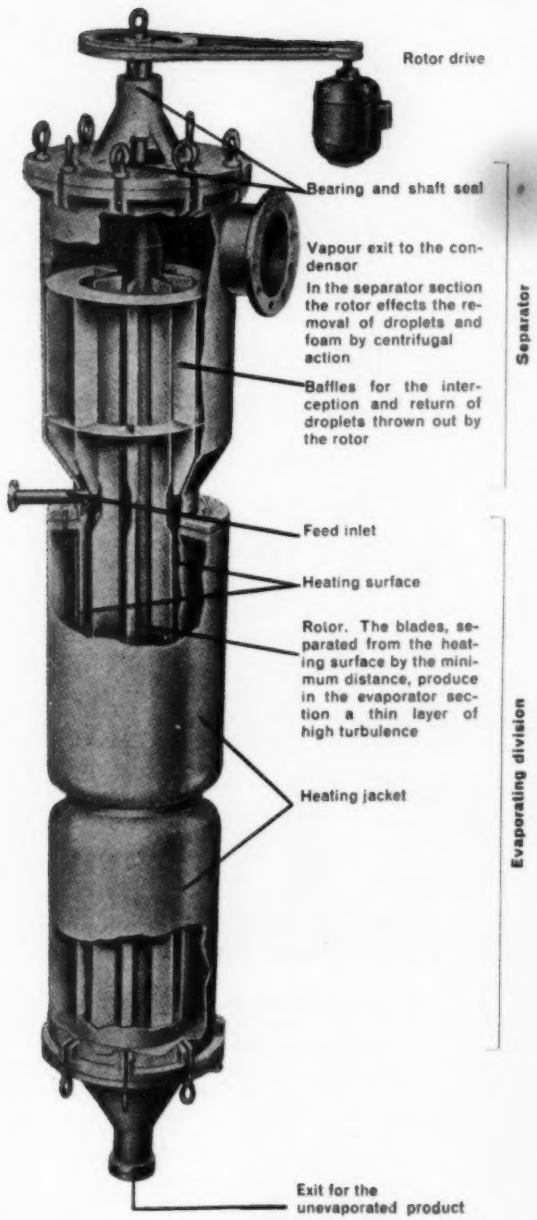
During 40 years of specialization in industrial dust control we've learned the answer to most dust problems. Take fine dry dusts such as graphite for example. Our answer to them has been the Drytube dust filter, which is particularly suitable for handling fine dry dusts where high collection efficiency is required.

DALLOW LAMBERT

DALLOW LAMBERT LIMITED · THURMASTON · LEICESTER · TELEPHONE: SYSTON 3333 (7 LINES)
CRC 98

LUWA THIN LAYER EVAPORATOR

- **EVAPORATION**
- **CONCENTRATION**
- **DISTILLATION**
- **DEODORISATION**


Rotor drive
Bearing and shaft seal
Vapour exit to the condensor
In the separator section the rotor effects the removal of droplets and foam by centrifugal action
Baffles for the interception and return of droplets thrown out by the rotor
Separator
Feed inlet
Heating surface
Rotor. The blades, separated from the heating surface by the minimum distance, produce in the evaporator section a thin layer of high turbulence
Heating jacket
Evaporating division
Exit for the unevaporated product

of all heat-sensitive liquids in any range of temperature, vacuum or capacity.

The modern Luwa system ensures for you the highest product quality, improved yields and the advantages of rapid continuous processing.

Why not take advantage of our great experience in the treatment of heat-sensitive liquids. The superiority of the Luwa Evaporator has been proved in the manufacture of many products including:

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- **Plasticisers**
- **Heavy and fine organic chemicals**
- **Natural and synthetic latices**
- **Fruit juice concentrates**
- **Vitamins and antibiotics**
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- **Gelatine**

Left—Type L Evaporator with fixed rotor blades having a small clearance from the heated wall.

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Type B Evaporator with hinged blades which contact the heated wall to remove deposits. Especially useful for treating slurries and solutions which precipitate solids on evaporation.

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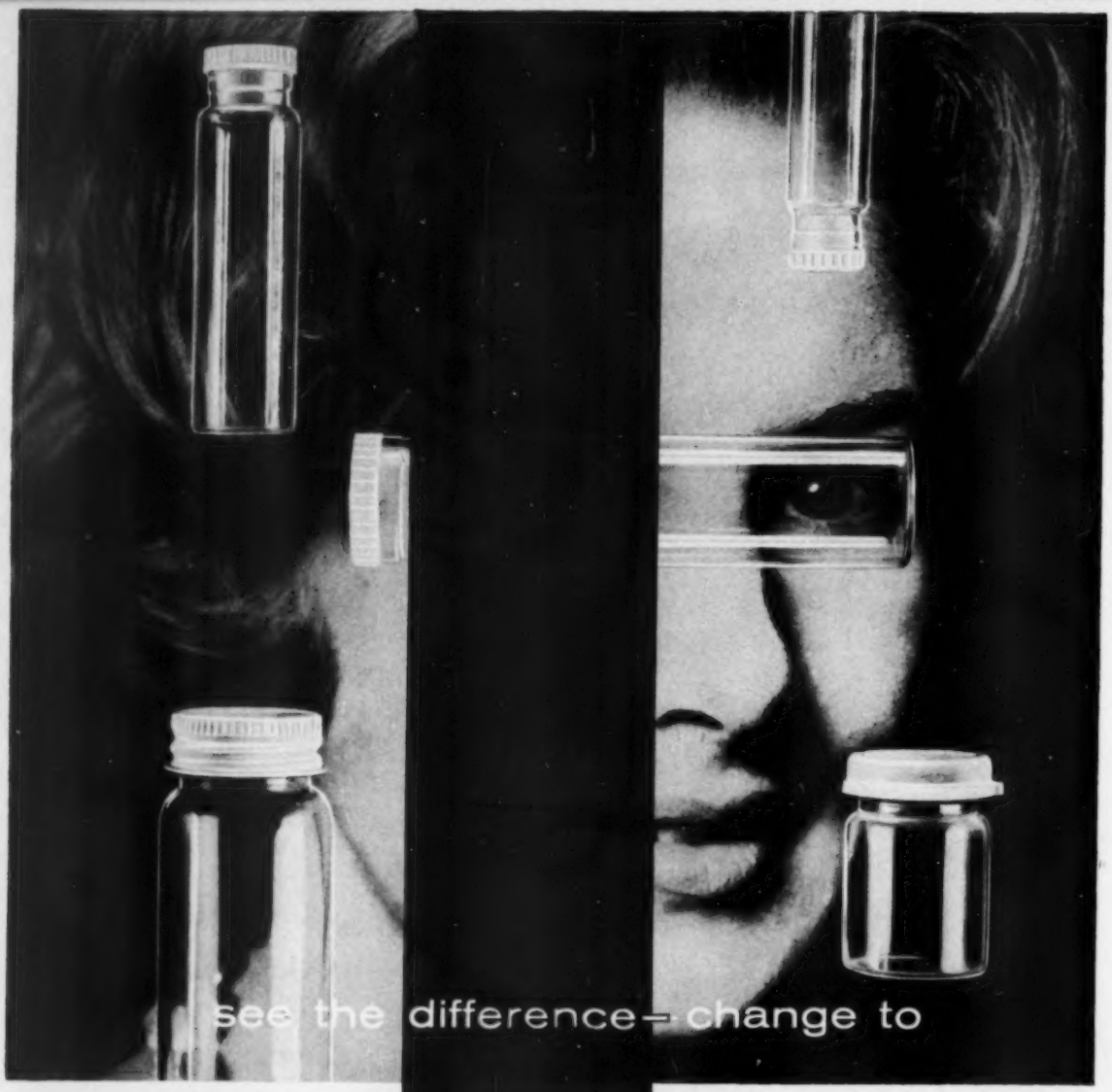

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CLEAR GL ONTAINERS

There's no doubt about it Trident tub ets to the very best advantage . . . in their true colours, size and shape. It is clea tents are and what condition they are in. Why don't you look at yourself in the Test-pack an established line in a Trident container and *see the difference*. For a h Trident. The evidence is as clear as the glass they're packed in—Trident cont

Drawn from bright clear tubing, size n. Polythene, Bakelite or Metal closures. Trident containers are light in weigh of space thus saving packing and freight charges. *Ask for our illustrated catalog*

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A.W. 3099

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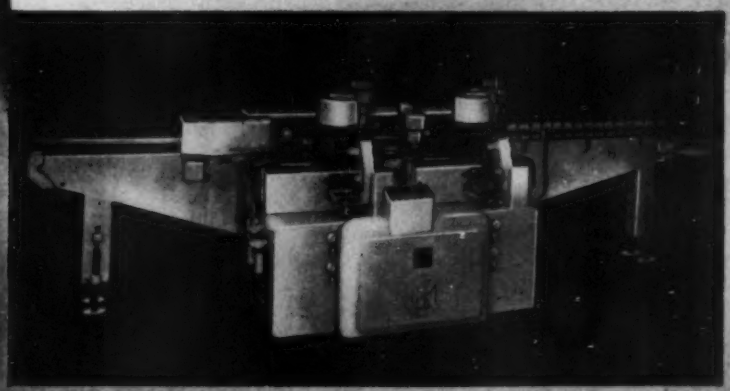
The Cyclone Duplex Flat automatic labelling machine is used by Messrs. Reckitt & Sons Ltd. for the high speed application of back and front labels to their Dettol bottle which is famous throughout the world.

The Banks labellers are also at work in 60 countries and in 250 towns throughout Great Britain. We manufacture 30 different models of the Banks labelling machine one of which may be just right for your application.



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Polythene Liners for the Chemical Industry

from Europe's largest maker of Polythene film

Now you can get polythene liners under the trade name 'Queensway', tailored for you by British Visqueen Ltd., the largest producer of polythene film in Europe.

What does this mean to you in the chemical industry?

Simply that the accumulated "know how", and the up-to-date equipment of British Visqueen are now geared to provide you with a comprehensive service for the design and supply of liners for all types of chemical containers.

EXPERT PACKAGING SERVICE British Visqueen have been the acknowledged experts on polythene film packaging for many years: they are the people who solve problems for packaging experts. They ensure the selection of the correct grade of polythene film, to be tailor-made into the ideal 'Queensway' liners for your products.

PROMPT DELIVERY Because of British Visqueen's modern equipment and large productive capacity, you can be sure of getting the right liners right on time, when you order 'Queensway' liners.

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BRITISH VISQUEEN LIMITED

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QW 169

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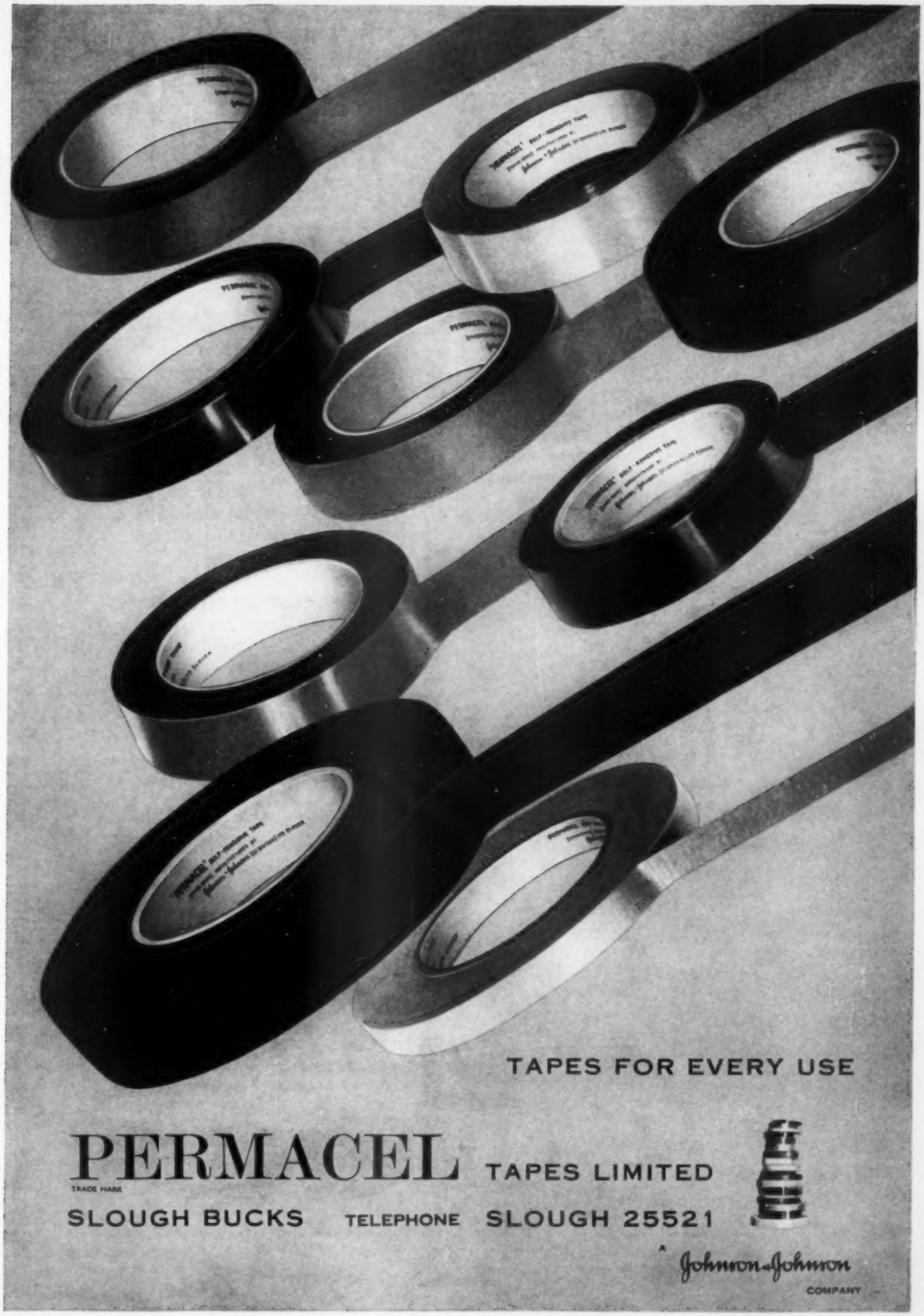
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only Metal Box can offer these, the largest selling, most reliable valves in the world.

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for purity and

consistency... choose

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the quality water-soluble ethers of cellulose

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Variable Flow EASICLEAN pumps

- 0 to 100 g.p.h. in either direction
- Stainless Steel and 'Pasim' construction
- Flow quantity indicator
- Dismantled for cleaning in 30 seconds
- Ideal for both light and heavy liquids
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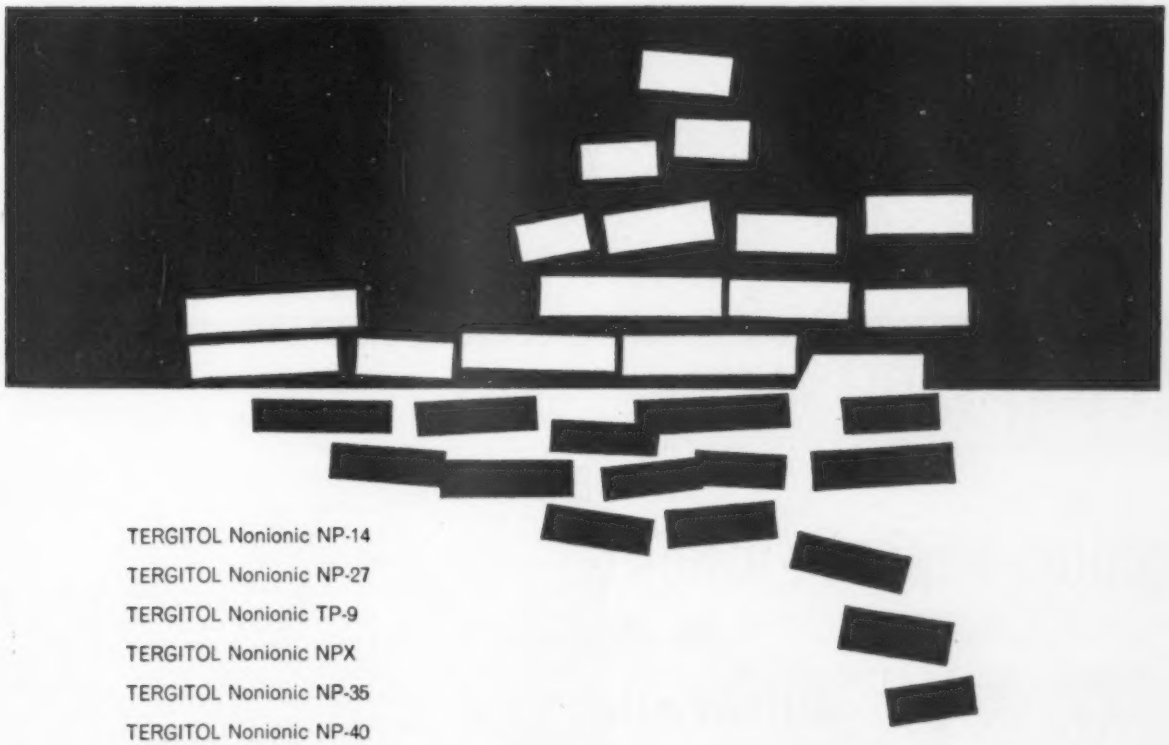

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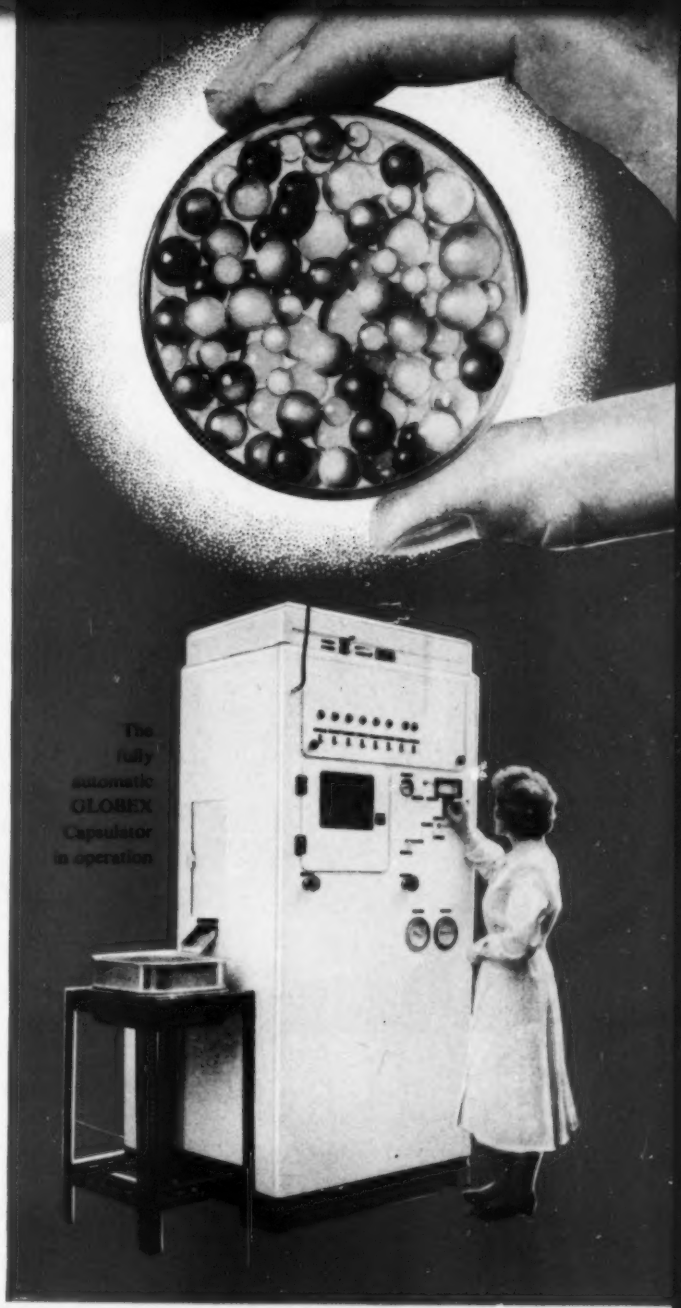

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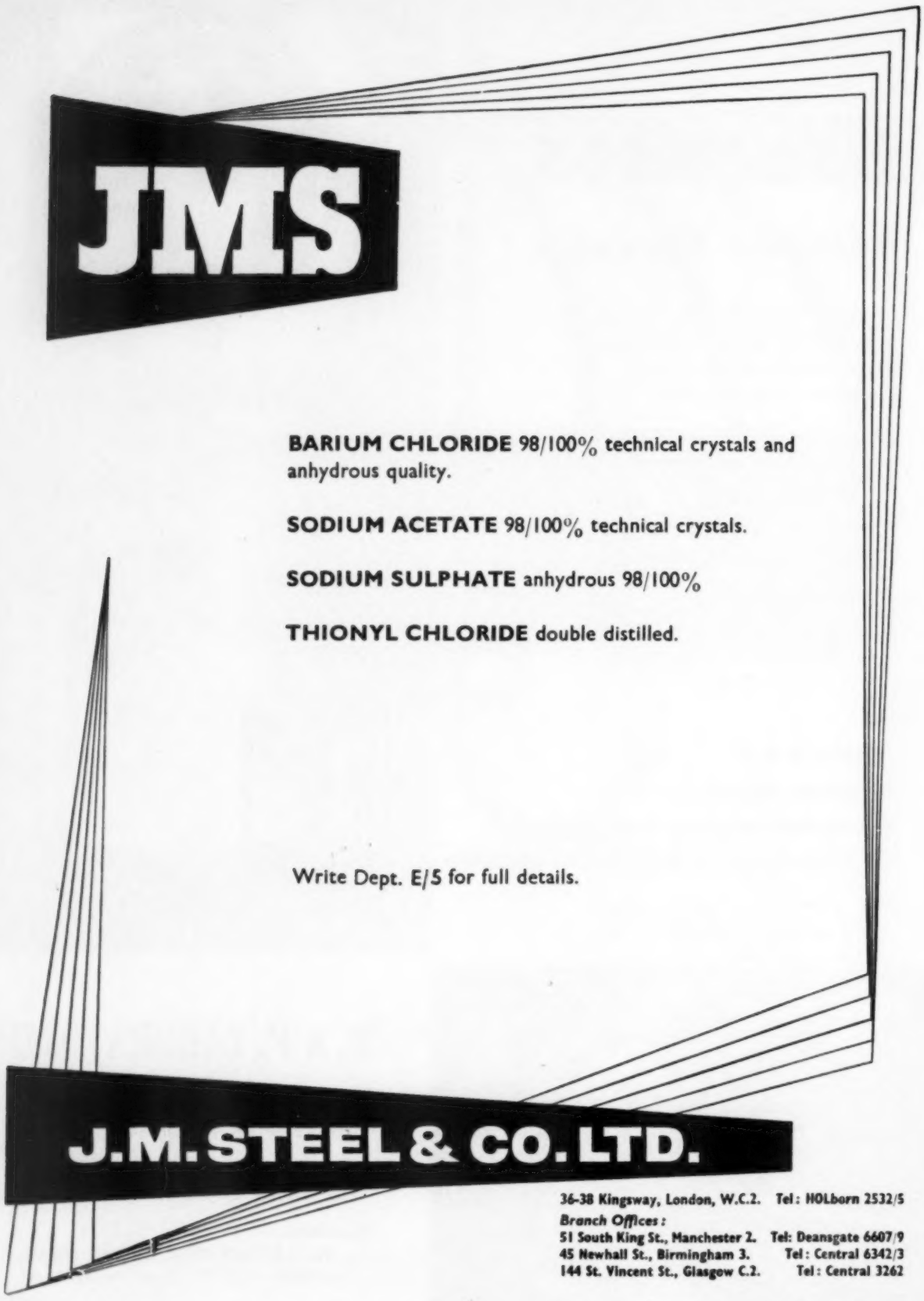

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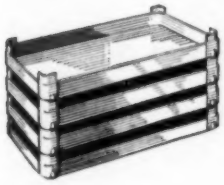

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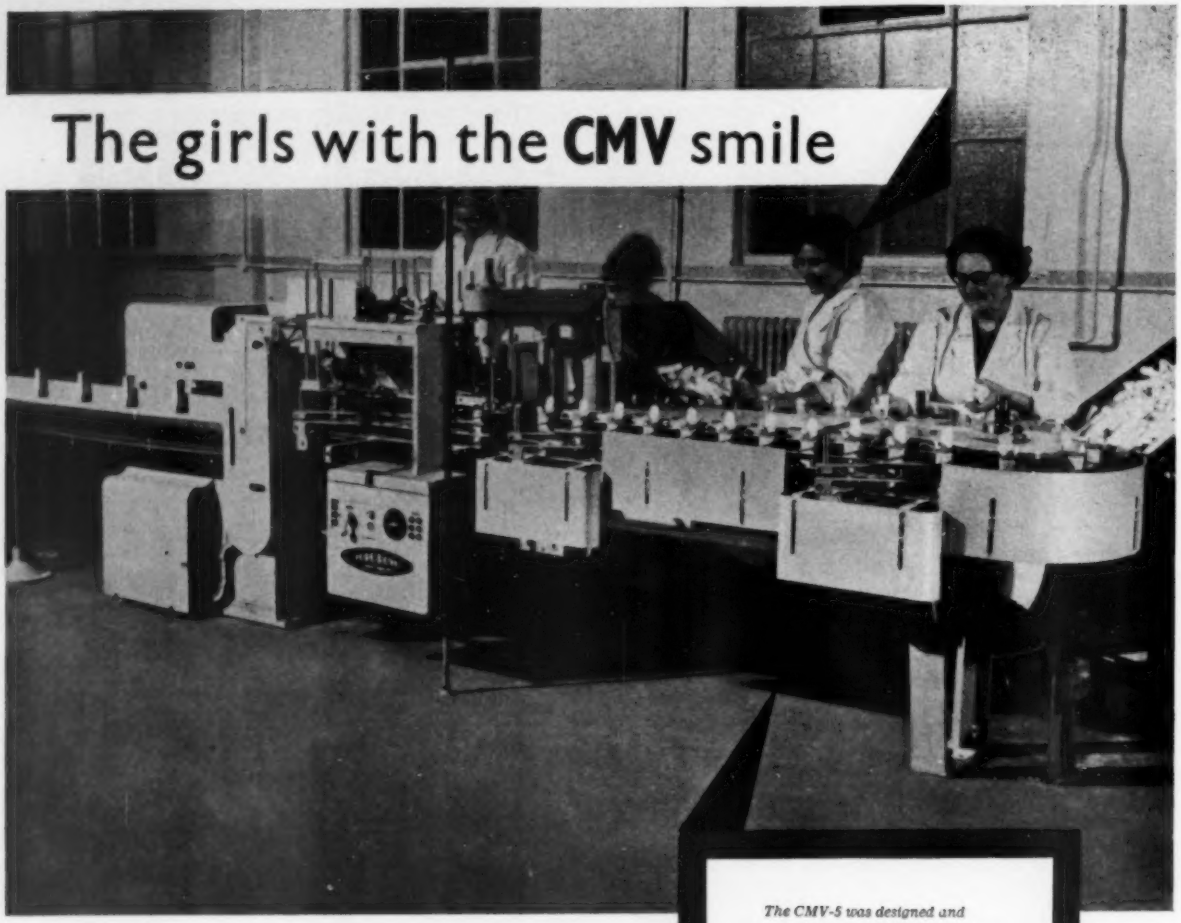

The CMV-5 was designed and proved by Jones of Cincinatti, is now built in England by Forgrove of Leeds. It automatically forms pre-glued cartons and closes the bottoms and tops. The unit illustrated is part of a packaging line that includes a Forgrove BW-6 machine which overwraps sets of twelve cartons in cellulose film.

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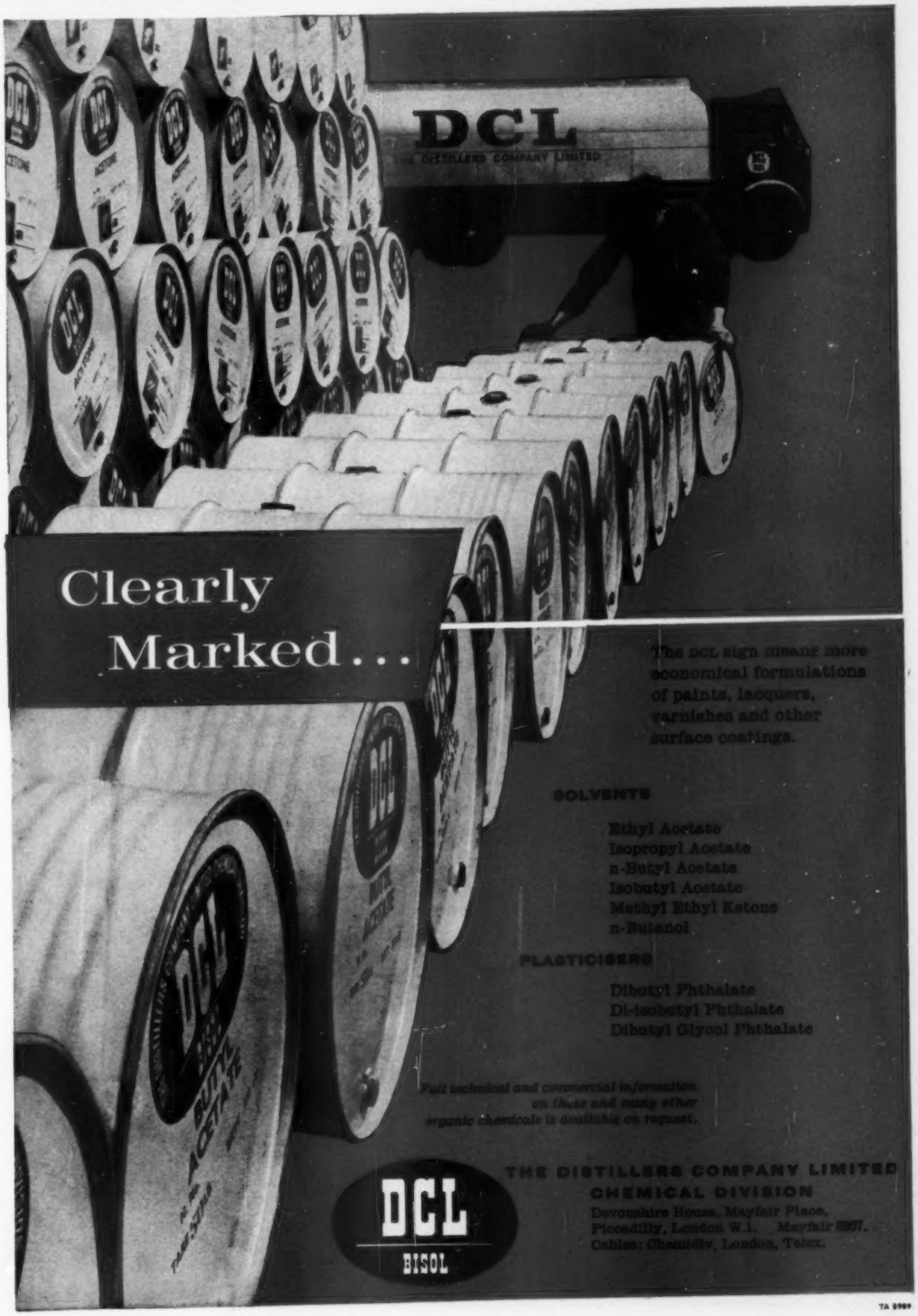

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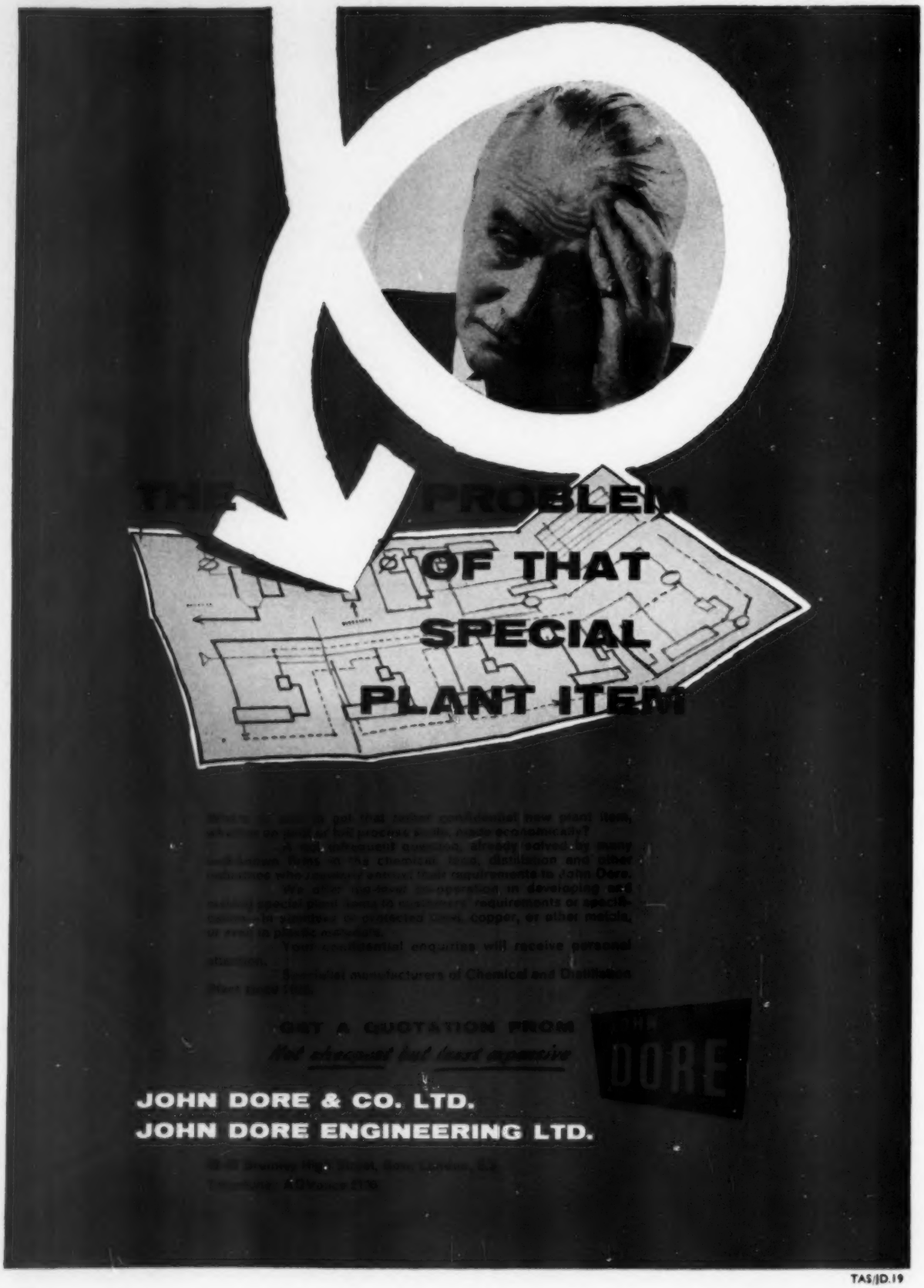
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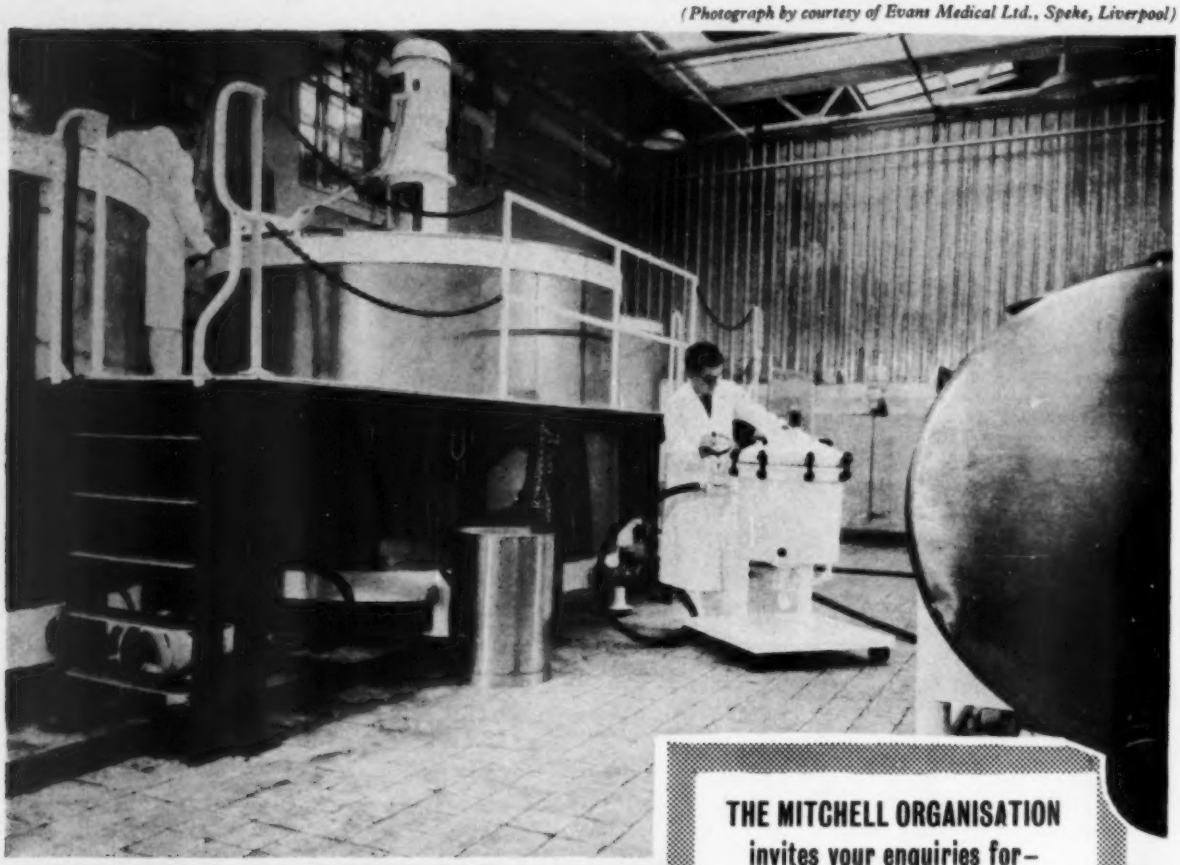

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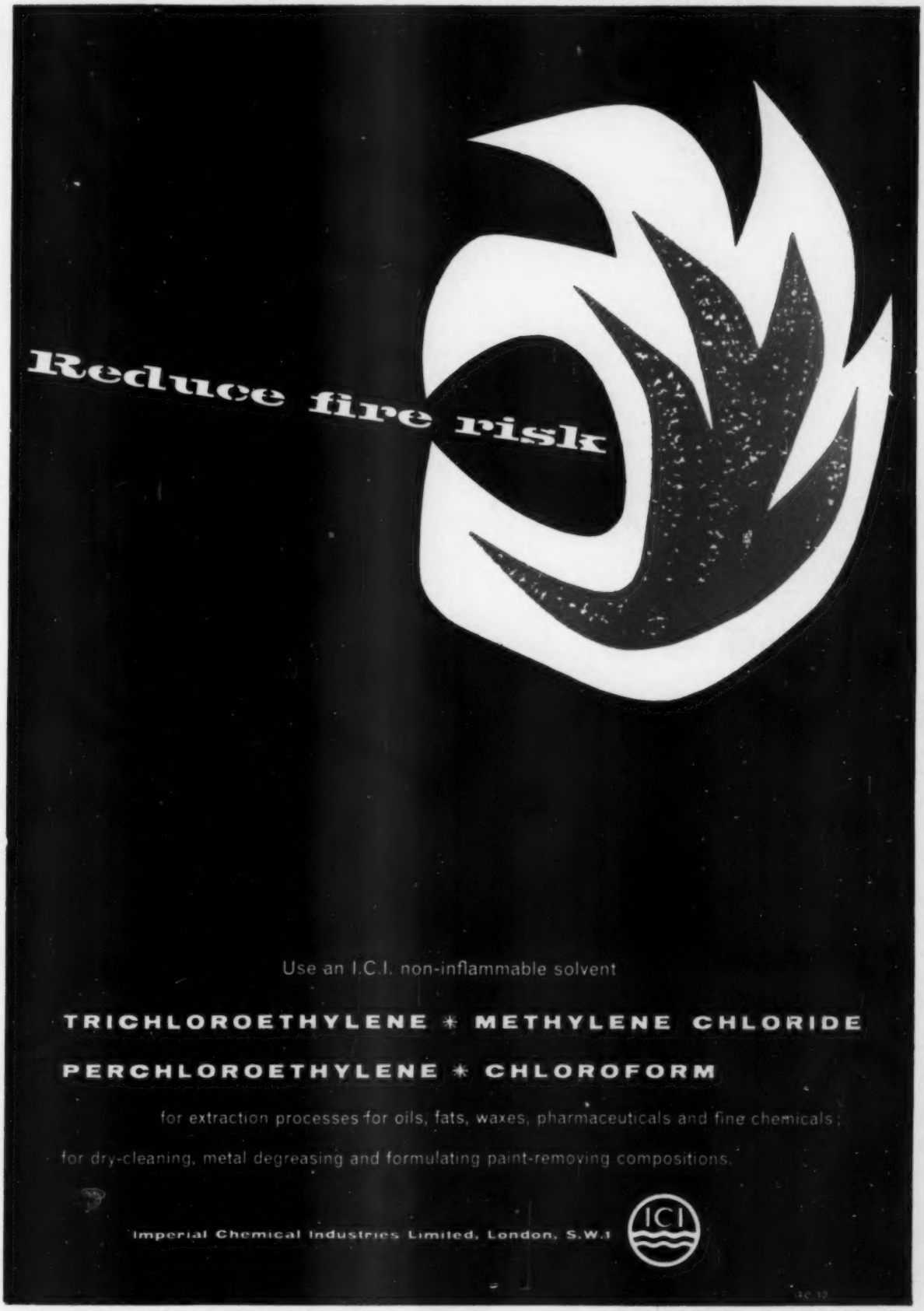
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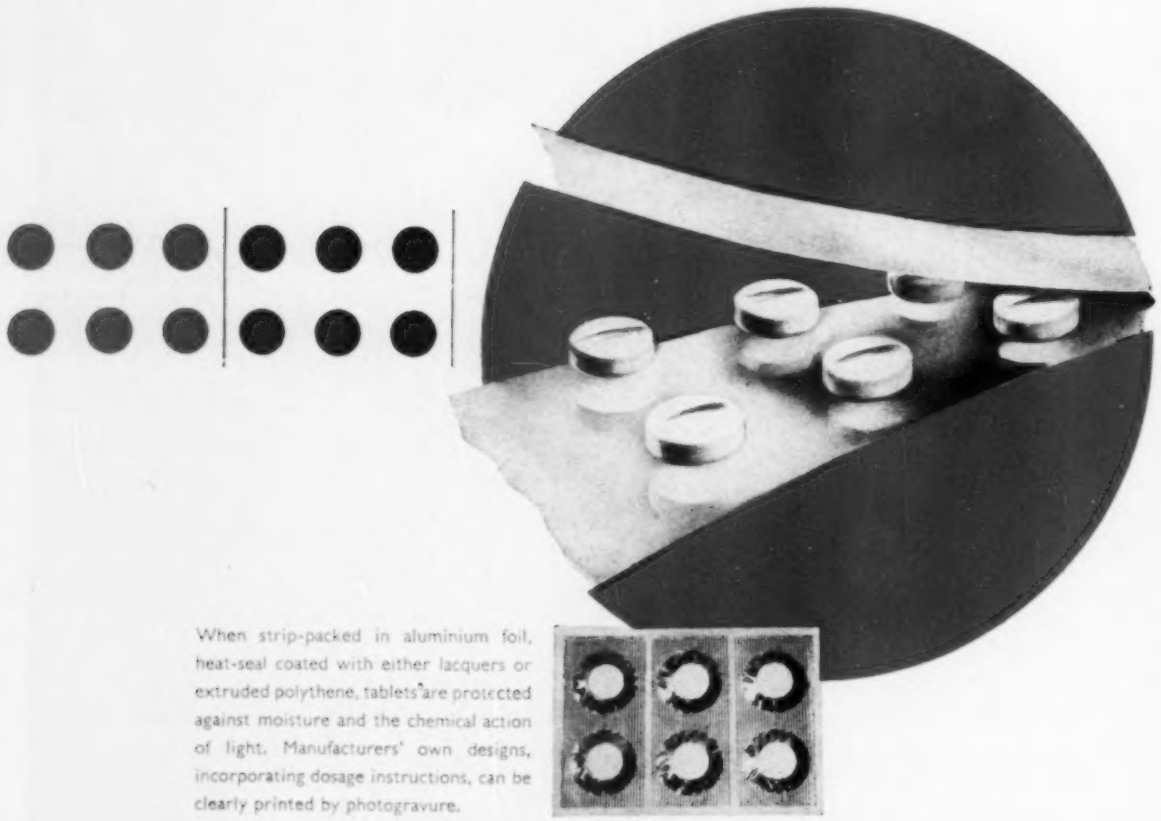

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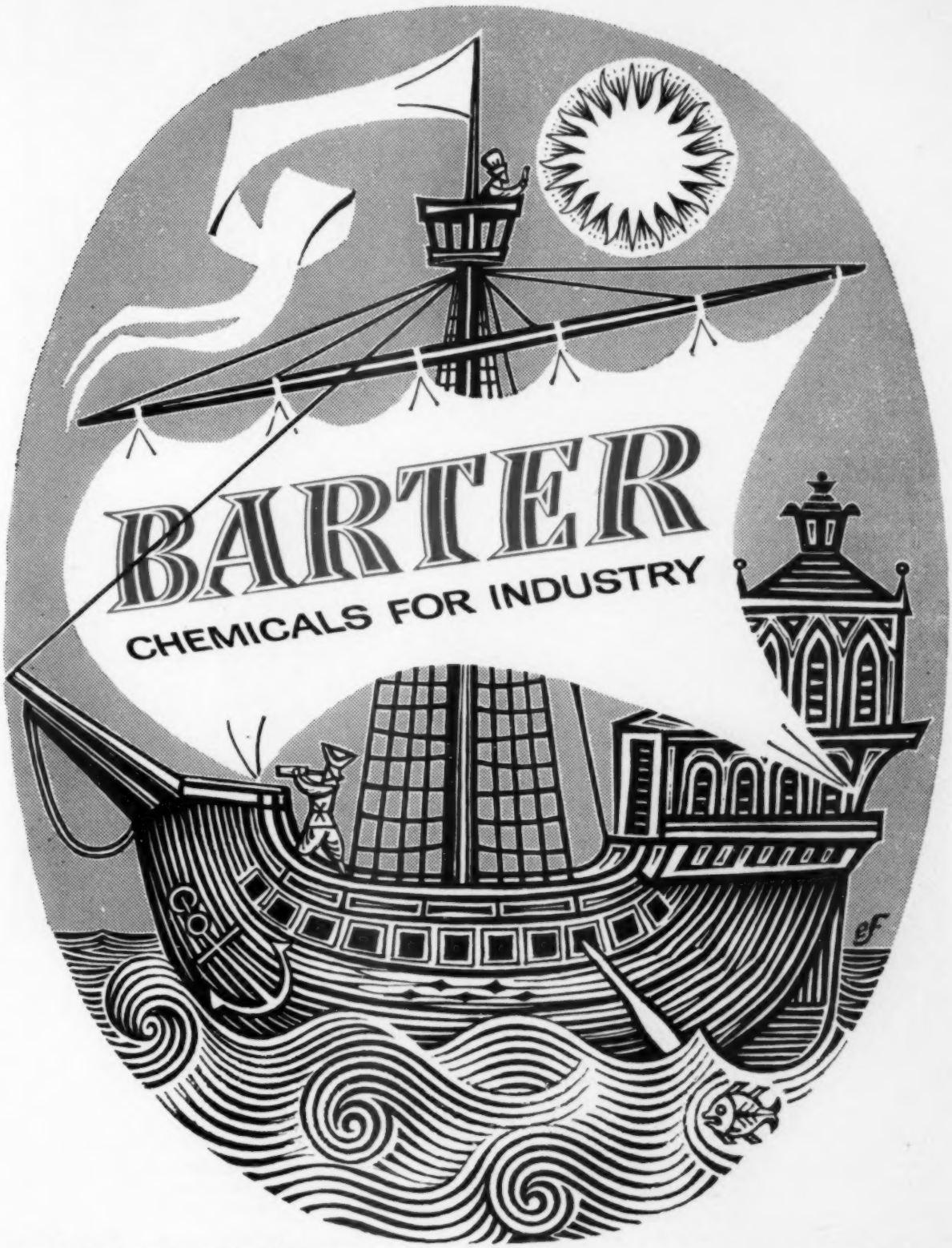

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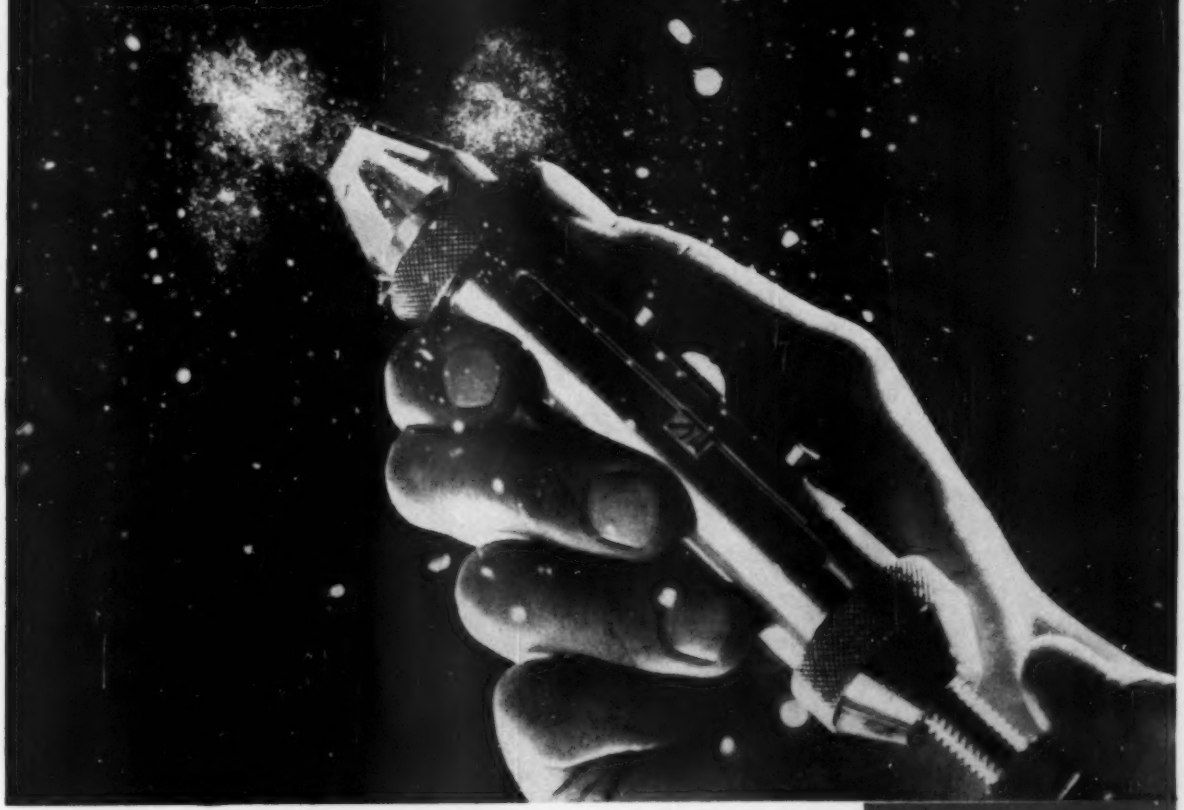

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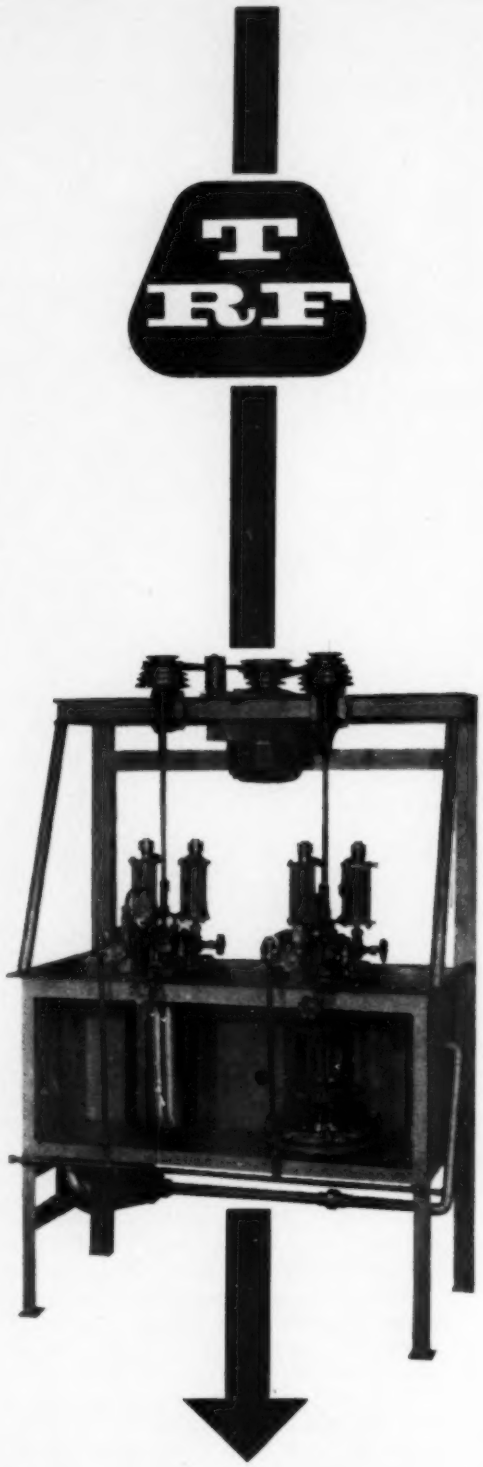

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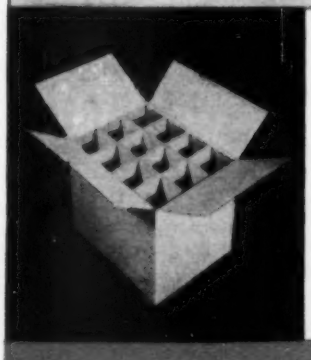

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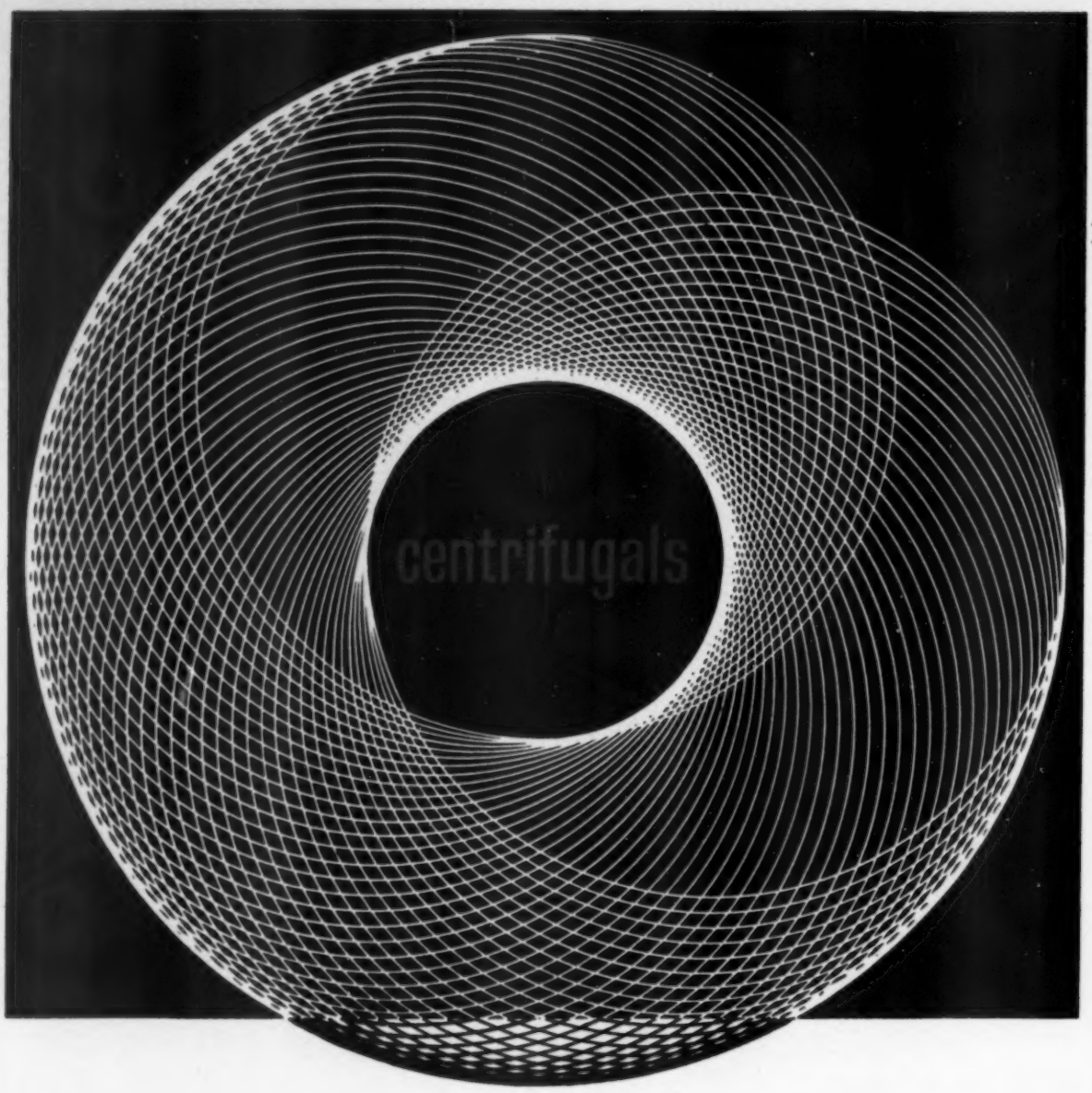

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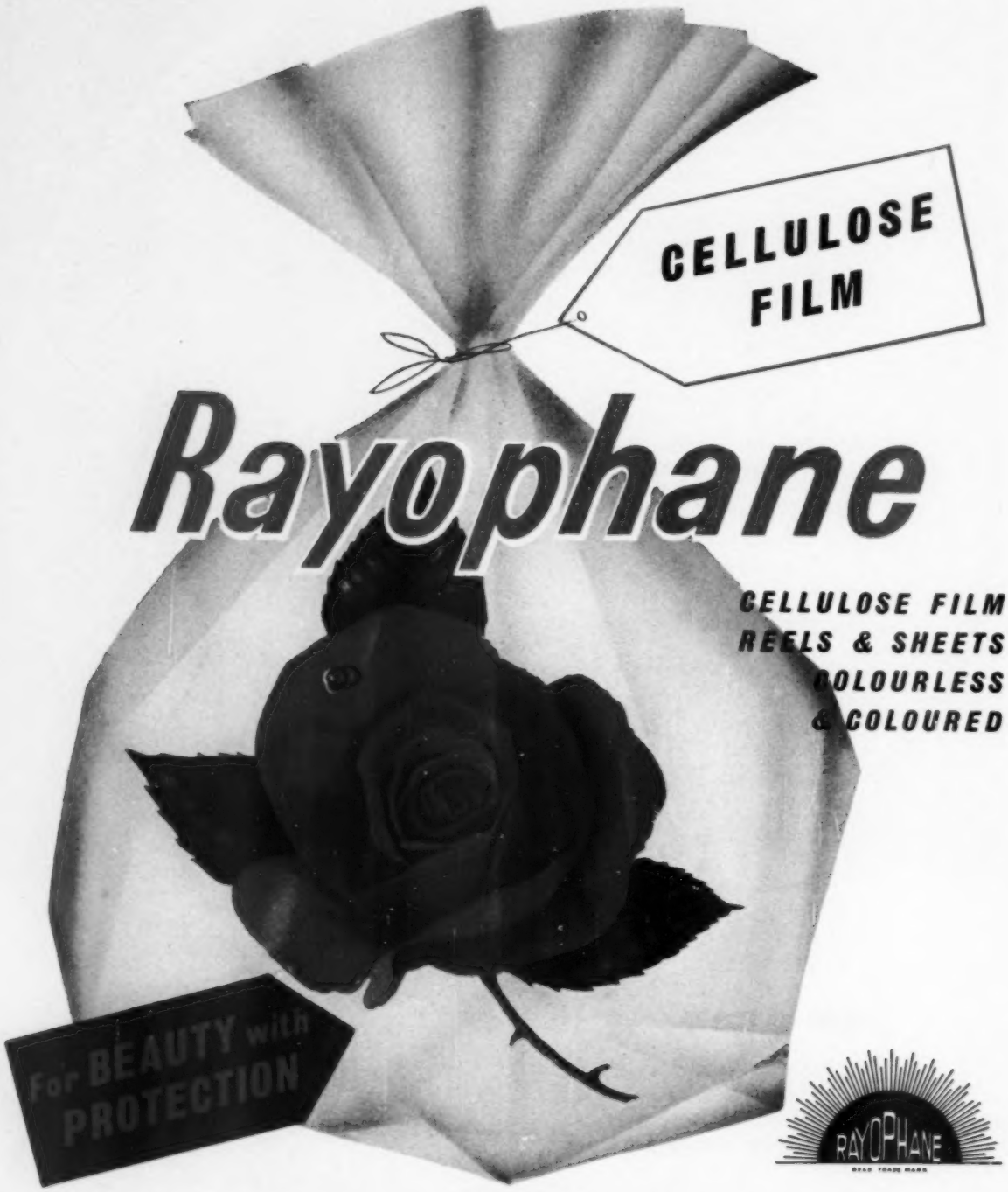

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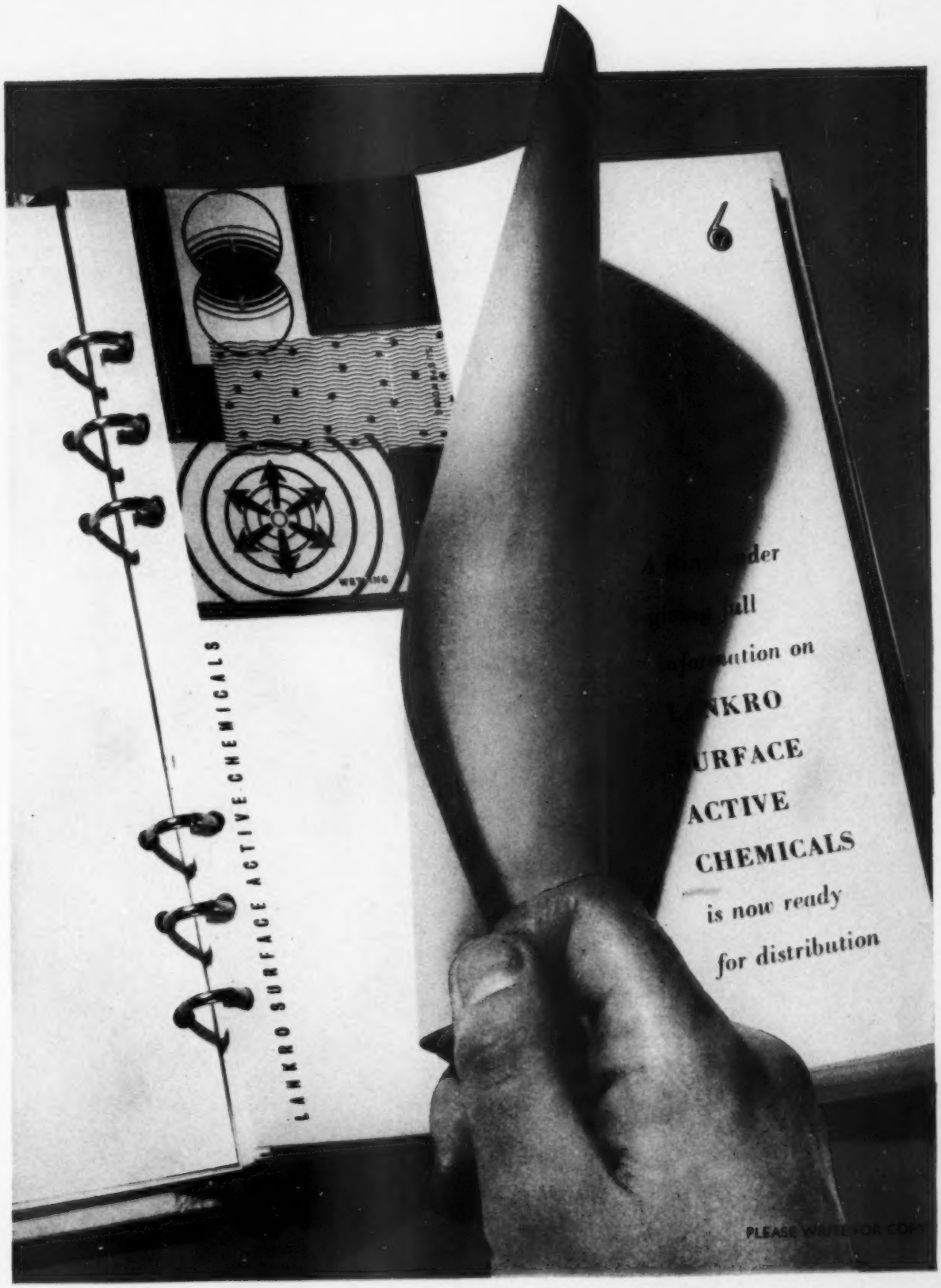

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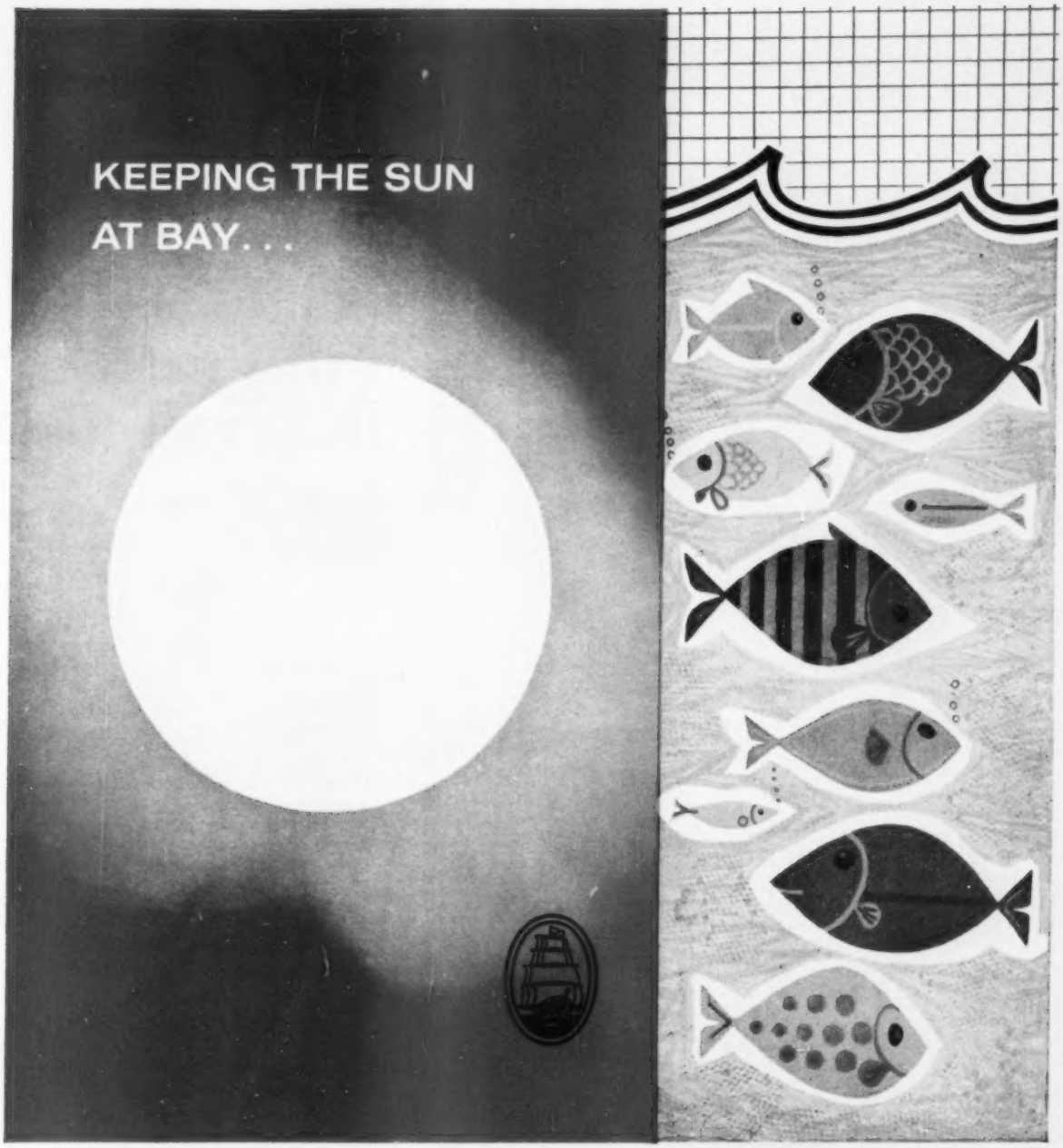

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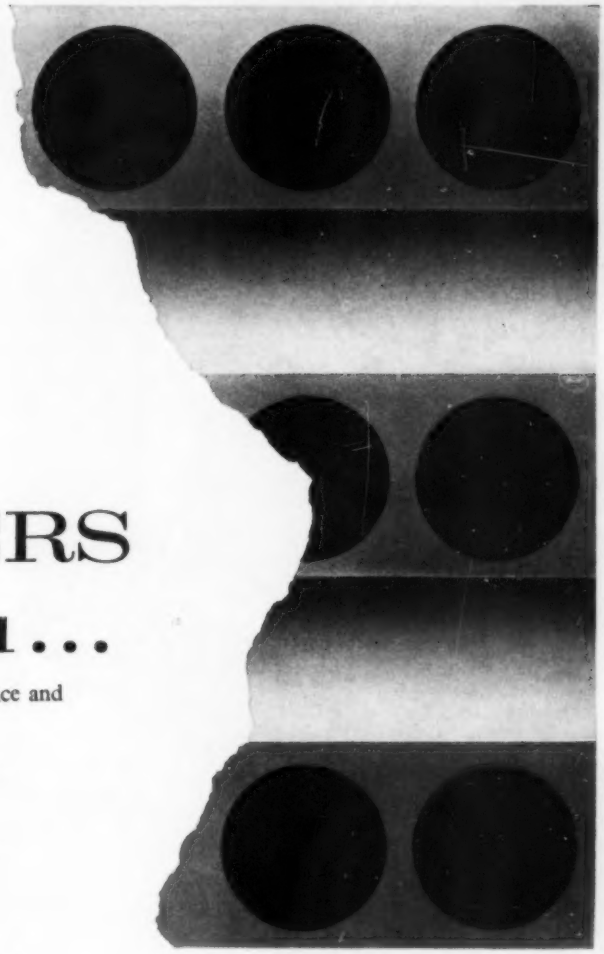

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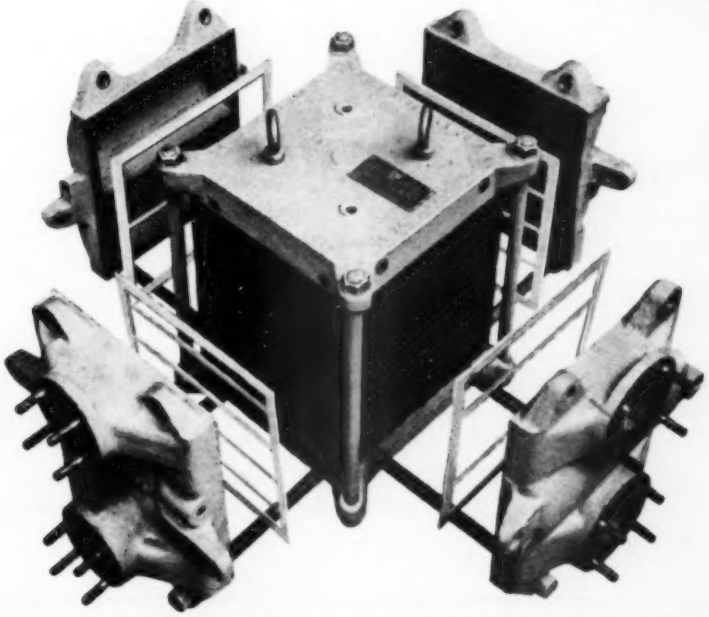

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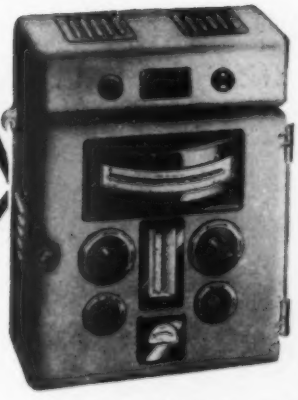

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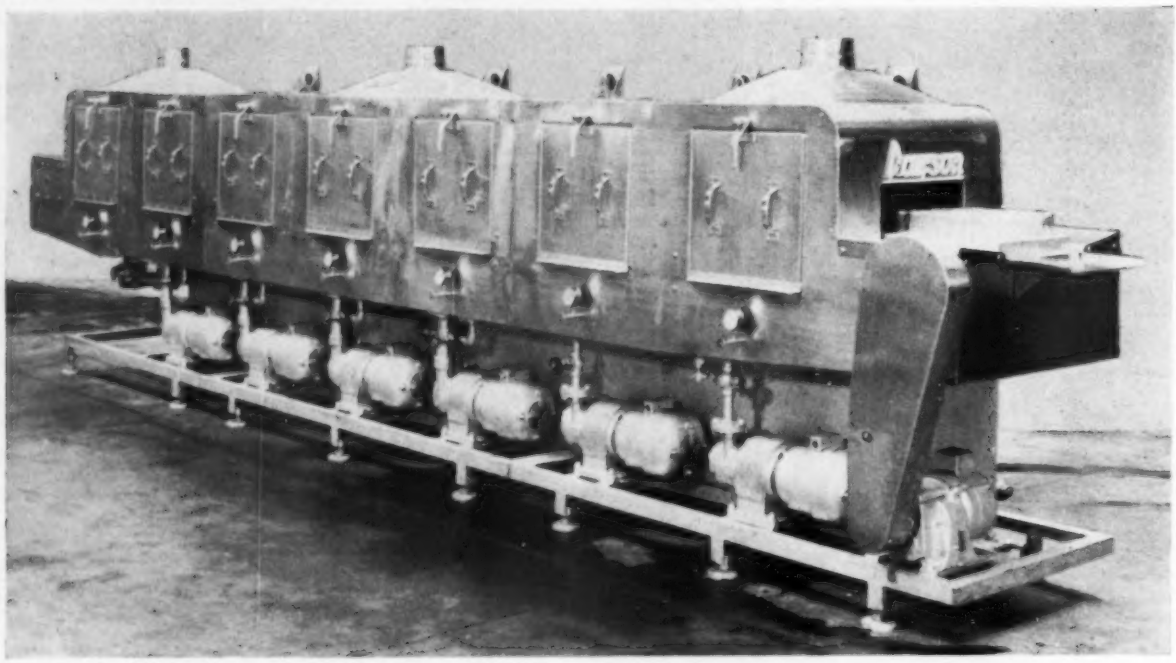

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1 oz., 2 oz., 4 oz. and 8 oz. Medical Flats
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4 oz. Toilet Ovals

This machine designed and manufactured to meet the specific requirements of Evans Medical Ltd., handles the wide variety of glassware listed in the adjacent panel. The items are carried in baskets on a moving conveyor through a multistage high temperature washing and rinsing treatment delivered by batteries of jets below and a series of spray boxes above, the final rinsing stages being with hot distilled water to ensure a high degree of commercial sterility. The machine which is constructed throughout from stainless steel handles up to 2,000 items per hour.

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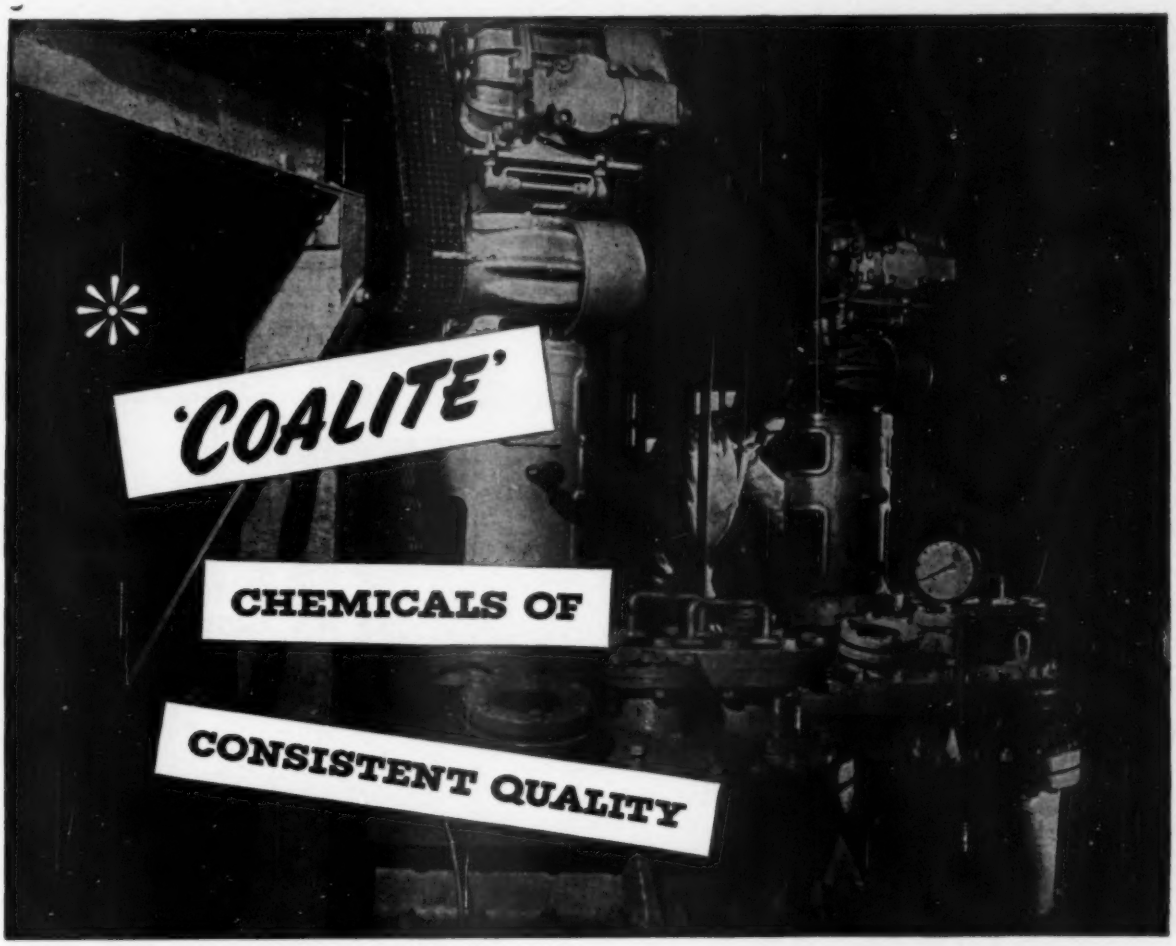

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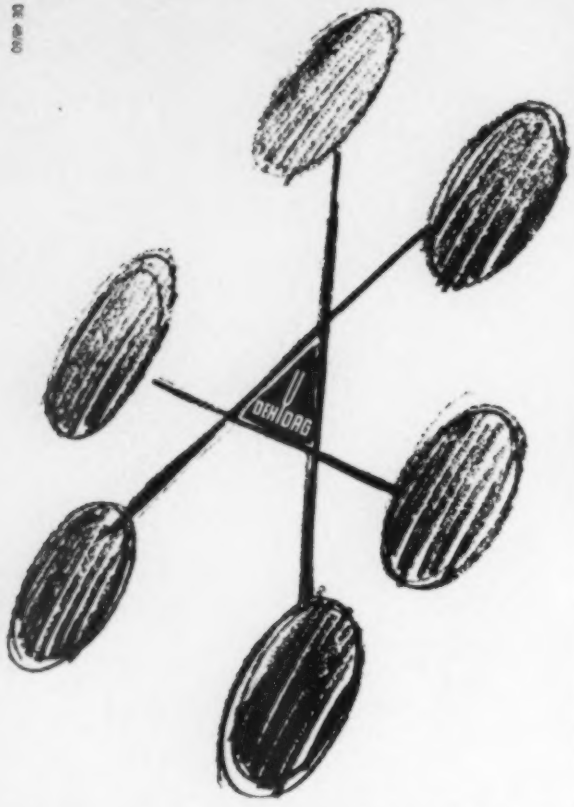

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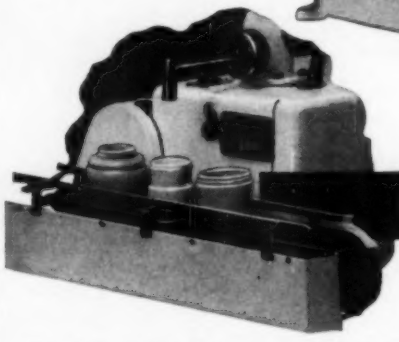

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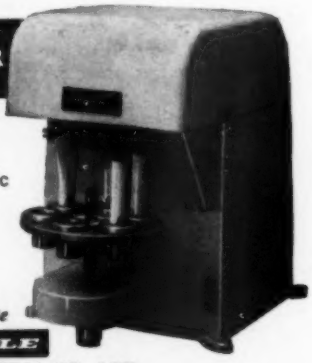

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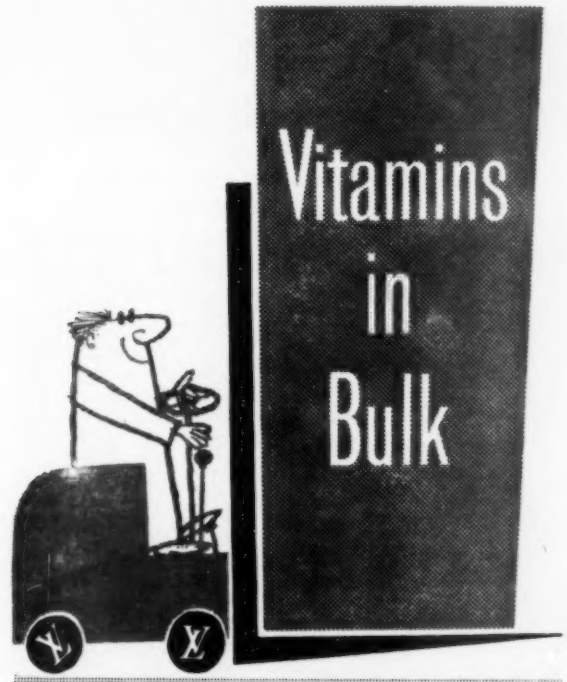

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Manufacturing Chemist

Editor: W. G. Norris

Vol. XXXII, No. 3 MARCH, 1961

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Mrs Morgan might be right...

The Glass Container-acceptance Testing Service will find out

The frustrating, nerve racking, thing about developing a new container is that when you have used all the marketing experience, all the know-how, the best brains, there still remains an element of chance. You never can be sure about a design until it has been submitted to the criticism, the approval or disapproval of Britain's 37 million packaging experts – the Mrs. Morgans, the consumers. You may have guessed right. You may have guessed wrong. Not far wrong maybe – just wrong enough to make all the difference. The maddening thing is that if you ever do discover what the Mrs. Morgans didn't like, it probably turns out to have been some footling thing that shouldn't logically have made any difference. That's the trick – consumers don't have to be logical – they don't have to be consistent, they don't even *have* to be consumers if they don't like your container.

It is to remove some of this guesswork (no matter how inspired) from container development, that Britain's Glass Manufacturers have set up the Container-acceptance Testing Service. This provides Packers with facilities to test consumer reaction to new designs *before* they go into mass production. They can be tested in any or all of the following four progressive stages.

1 Design Preference Testing. Any new design can be tested on a consumer panel of 400 households. Their preferences will be analysed and presented to the Packer as a report and recommendation.

2 Container in Use Testing. The new container and its product can be tested in actual use in the home. The panel's experience of the new pack will be recorded, analysed and furnished as a report.

3 Shelf Testing. The sales appeal of a new container can be tested under real store conditions, on the shelves of self-service or other stores. The speed and volume of off-take will be audited and analysed by type of store and locality. The new pack may be tested either alone or against any alternative.

4 Area Test Marketing. It was felt that facilities to convert shelf testing into a test marketing operation would be welcomed by some Packers. To make this possible an expertly staffed marketing service has been established which will plan, organise and, if desired, execute test marketing campaigns in their entirety for Packers launching new glass packed products.

Free Service. Because the Glass Manufacturers believe that these services should be used as widely as possible, all the facilities under headings 1, 2 and 3 are offered *free* as a service to the packing industry. The only cost to the Packer under these headings will be in the supply of goods, containers and such items as labels and transport. In the case of Area Test Marketing schemes however, a nominal charge will be made for planning the operation.

Security. Where any of these tests are carried out on new products, the whole operation can be executed with absolute security. Packers can have complete anonymity by employing one of the several brand names that have been registered especially for this purpose.

If you would care to have further details of this service, please do not hesitate to ask, irrespective of whether your interest is immediate or not. Your Glass Container Manufacturer will be happy to discuss your problem and to help you in any way. Details of this scheme have been published as a booklet, copies of which are available on request from your Glass Manufacturer or from the Federation.

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THIS IS AN ADVERTISEMENT OF THE GLASS MANUFACTURERS' FEDERATION
19 PORTLAND PLACE · LONDON W1
TELEPHONE: LANGHAM 6952

Stopping holes in the tariff wall

THERE is a fundamental difference in the way tariffs are treated in the European Economic Community (the Six) and in the European Free Trade Association (the Seven). In the E.E.C. it is intended to eliminate all tariffs between the six countries themselves and to have a common external tariff applying to the rest of the world.

The Seven, of which Britain is the leading member, will reduce and finally remove all duties on goods passing between the seven countries. However, they will not establish a common external tariff but will operate their own external tariffs as before. This somewhat "make do and mend" arrangement exposes our industries to the danger of goods being exported to a low tariff member of the Seven and then being re-exported to Britain, thus evading the proper duty. This could be serious for our chemical industry which operates behind a 33⅓% tariff wall. For this reason "certificates of origin" are necessary in the EFTA. They will take the form of declarations sent with the chemicals claiming the reduced or duty-free importation privilege, as being goods originating within the Seven. By this means it is hoped to prevent outside countries, who have not given us the benefit of reductions in their tariff, securing unlawfully the reductions we have given to our partners in EFTA, namely Norway, Sweden, Denmark, Switzerland, Austria and Portugal.

"Certificates of origin" are thus important new documents for the commercial managers of the chemical industry. The Association of British Chemical Manufacturers has published an admirably clear booklet explaining the origin, rules, certification and segregation of stocks, as agreed by EFTA. It consists of papers by experts and is completed by six pages of explanations based upon the enquiries received by members.

Readers may apply to the ABCM for information on the extent to which knowledge of the "origin" of the chemicals they use is essential in deciding the "origin" of the products they export. The booklet itself is obtainable from 86 Strand, London, W.C.2, at 3s. 6d. post free.

Risks of innovation

WHEN the National Research Development Corporation was set up 11 years ago Parliament placed upon it the duty of obtaining sufficient revenue from its operations to balance its outgoings, "taking one year with another." The people who planned the N.R.D.C. and laid upon it this financial duty could not have thought very deeply about it. The very nature of its work makes the Corporation a risk taker. In fact it borrows at fixed rates of interest from the Board of Trade to finance long-term risk ventures at a level something like double its revenue incomings. By the time returns are received on successful projects the accumulated interest on borrowings to cover both successful projects and failures will be a formidable sum. Indeed, the Corporation has an impossible financial task. While industry normally pays for the development which it undertakes out of the trading profits which it earns, the Corporation has to rely on patent royalties and specific development recovery arrangements made with its licensees. These normally represent a small part of the trading value of the developed article or process.

That the Corporation is unhappy about its financial problems is abundantly plain from the latest annual report. Its excess of outgoings over incomings is now nearly £3 million and the interest for which it is liable for Board of Trade advances is £515,494.

The Corporation was set up to stimulate the development of invention in Britain. Its work is inherently risky and it is difficult to see how it can ever balance its accounts in the way Parliament requires. The Government will have to think again about the N.R.D.C. Meanwhile it is worth recording that seven of the Corporation's major revenue-earning inventions are chemical ones, namely cephalosporin C, tri-iodothyronine, Prof. Wain's selective weedkillers, anti-thyroid compounds, hecogenin, carotenoids and anti-cancer compounds.

S.O.S. centre for poisons

DEATHS from accidental poisoning—whether by gas, medicines or cleaning agents—have nearly doubled in the last ten years. There are 7,000 to 8,000 deaths annually from these causes in the home.

Four out of five victims are either children under five or people over 65. There are at least 70,000 annual hospital admissions and 1½ million out-patient attendances for accidents.

This alarming situation has led a standing committee of the Ministry of Health to recommend the setting up of a Poisons Reference Centre. It would provide a 24 hr. information service and would answer questions from anyone wanting to know the contents of any proprietary preparation, its lethal dose and appropriate antidote. The United States already has such centres.

The Parliamentary Home Safety Group has been pressing for legislation on the same subject and would also like to see special cupboards included in new houses where poisons could be locked away from exploring children.

It seems, from the astonishingly high figure of poison deaths that however careful manufacturers

are with their labelling and pharmacists with their dispensing, the general public is still careless. Under these circumstances it would be a useful service if manufacturers and chemists printed the antidote for the product on the label.

Technology versus poverty

PROF. P. M. S. BLACKETT, physicist and Nobel prize-winner has long and passionately sought to arouse our collective conscience to the plight of the have-not nations. He speaks with particular authority on India and China. These countries have a *per capita* income of some £40 p.a., one-tenth of that of the Western world. Our income and prosperity rises by about 2% p.a., so the gap between us and the have-nots is widening all the time. The rich get richer and the poor relatively poorer. To achieve the take-off towards Western-style industrialisation the have-nots want capital. According to Prof. Blackett it is as simple (or difficult) as that. Not all the research in the world can wave a magic wand and produce a solution which will work without capital. In simple self-interest, if not for reasons of morality, it is up to the West to pump in capital—much more than is being done at present. If we don't others will.

This is the cause to which Prof. Blackett has committed himself. He emphasised the urgency of his message once again when he gave the Hinchley Memorial Lecture to the Institution of Chemical Engineers in London last month. But he was not speaking simply to a group of educated and humane men. He was speaking to the technologists who create the plants which produce the fundamental needs of the have-nots—fertilisers, pesticides and weedkillers. These chemicals do the basic job of increasing food production. Before men can think about improving themselves they must be properly fed. Japan, which has leapt far ahead of its Asian neighbours, uses 100 lb. of nitrogen per acre; India, still struggling desperately with poverty, uses 1 lb. India needs to put up one fertiliser plant a year to satisfy its requirements of sulphate of ammonia—each one capable of making 300,000 tons p.a. The cost of such a plant is about 100 million dollars, a severe strain on scarce foreign exchange.

Prof. Blackett wondered if smaller chemical plants could be designed at a price capable of being paid by smaller units than large central governments. He urged his audience to study the capital goods market of India and other countries. They do not necessarily require the expensive labour-saving plants of the West; more acceptable would be plants that consume more labour but less capital. Firms operating in the have-not countries could also help educate the local people in their factories. Factories are a good substitute for technical colleges. Our forefathers learned their skills on the factory floor; the colleges came later for a more privileged population.

With a grant of 200,000 dollars from the Ford Foundation, a new organisation has been formed in London. It is the Overseas Development Institute. The chairman is Sir Leslie Rowan, chairman of Vickers, and other big industrialists sit on the council. Its job is to help under-developed countries, so it is well placed to centralise the efforts of industry in this direction. Its address is 160 Piccadilly, W.1. Firms who see the task of assisting the have-nots as enlightened self-interest (a market composed of paupers is a poor one for a rich country to sell to) might like to get in touch with the new Institute.

Process equipment standardisation

FOR twelve years the process industries have had their own engineering standards organisation, working closely with the British Standards Institution to try to get sensible standardisation of engineering materials and equipment. This is the Engineering Equipment Users Association. Though there are but 13 members they represent a large part of the process industries. Eight of the 13 are chemical companies, namely Albright and Wilson, Courtaulds, Distillers, Dunlop, I.C.I., Laporte, Shell and Unilever. Other members include the National Coal Board and the Atomic Energy Authority. Between them these organisations spend hundreds of millions of pounds on engineering equipment. So clearly they have a right to seek a better ordering of these vast supplies through common standardisation. Users of engineering equipment (not manufacturers) who feel they could gain by joining the E.E.U.A. can get a newly published descriptive brochure by writing to the General Secretary, 20 Grosvenor Gardens, London, S.W.1.

Anæsthetic analyser

EQUIPMENT for analysing anæsthetics by gas chromatography has been developed by research workers at the Royal College of Surgeons. It can be used during operations to check the composition of the anæsthetic mixture and for pharmacological research because it can analyse the uptake, distribution and elimination of anæsthetics in blood and tissues.

The prototype was shown at the Physical Society Exhibition. A more compact version is being developed in co-operation with the British Oxygen Co. Ltd., who may be able to market it for as little as £200. An infra-red analyser, such as is used at present for analysing anæsthetics, might cost £600.

The gas chromatograph will handle all components of anæsthetic gases, including oxygen, nitrogen, carbon dioxide, nitrous oxide, cyclopropane, diethyl ether, halothane, chloroform, trichoroethylene and methoxy-fluorane. It is thus more versatile than an infra-red analyser. But it is not so quick, taking about 8 min. to analyse a sample. For this reason it cannot be used to follow the gas concentration changes occurring during an individual breath, but it can be used to monitor gas and vapour concentrations in breathing circuits. It can also determine wash-in and wash-out curves of anæsthetics, for testing vaporisers and demonstrating to students. The

method can also be extended to determining gas and vapour tensions in biological fluids such as blood.

The application of the new apparatus to practical anæsthesia can be illustrated by its use for checking the halothane component of a " maintenance " gas such as nitrous oxide. The adjuvant is metered into the breathing circuit by a vaporiser, normally very accurately. Should a defect arise, however, gas chromatographic analysis, applied to the mixture, would quickly reveal it. In the anæsthetist's jargon, it is a way of calibrating vaporisers. Apart from the paramount aspect of safety, accurate metering of halothane helps economise on the use of this expensive product.

In recording the latest application of this amazingly successful and versatile analytical tool, it is appropriate to recall that it was invented by James and Martin in the laboratories of the Medical Research Council. The time was 1952 and the problem the analysis of fatty acids.

Farm chemicals—mark of confidence

THE FIRST list of products approved under the Agricultural Chemicals Approval Scheme has been published by the Ministry of Agriculture. The new scheme replaces the 20 years old Crop Protection Products Scheme which was never as widely known as deserved and had the fault that a chemical could be on the market for two years before it was approved. Under the new scheme it should be possible to grant approval to a chemical by the time it is ready for marketing, provided the manufacturer co-operates fully.

The plan will operate in this way. When a manufacturer is planning his field trials he will inform the Approval Organisation, in confidence, of the chemical composition of his product, the work he has done so far on it, and the trial programme that he intends to carry out. The Organisation will advise whether the proposed programme is satisfactory. If the Organisation wishes to have independent evidence as well, it will arrange for independent field trials—another important feature of the new scheme.

No chemical will be approved unless it does the job it is intended for properly. Claims made for products under the old scheme were thoroughly reassessed before being re-registered in the new scheme.

The scheme does not deal directly with safety requirements for agricultural chemicals, but approval cannot be given to a product containing a toxic chemical unless its safety has been cleared under the voluntary notification procedure and recommendations made about any precautions considered necessary.

Over 400 products now carry the special " approved " label. It is hoped that this scheme will gradually discourage the use of unsatisfactory products, and the mark will become a familiar sign of reliability.

Therapeutic toothpaste

THE STANNOUS fluoride toothpaste *Crest*, developed by Procter and Gamble, and the first to receive the endorsement of the American Dental Association, presented difficult cosmetic problems. The biggest headache was finding a flavour to mask the bitter, astringent note of the active ingredient. Mint oils proved unsatisfactory and after many tests a blend of wintergreen, cassia and anise was chosen. The flavour was well liked, especially by children.

Another problem, according to D. S. Barrie, writing in the *American Perfumer* (1960, (12) 33), was finding a sudsing agent. Alkyl sulphate is believed responsible for the "orange juice reaction," the bitter taste akin to that which orange juice sometimes produces immediately after brushing the teeth. It was overcome in *Crest* by combining monoglyceride sulphonate with alkyl sulphate; this blend is particularly good for toothpaste because it produces a quick but lasting foam.

The first binder used was gum tragacanth but it was found that by using carboxymethyl cellulose as the binder, the taste and odour of the toothpaste was improved. Later *Veegum* (colloidal magnesium aluminium silicate) was added to improve the ribbon texture. In choosing a polishing agent it was found that calcium carbonate and dicalcium phosphate quickly precipitated stannous fluoride; then it was found that calcium pyrophosphate was compatible with the fluoride.

It is clear that the formulation of this effective anti-decay dentifrice was not just a matter of adding stannous fluoride to a conventional recipe. The product had to be completely reformulated. Its success is the more rewarding to those who worked on it. It is expected that P. & G.'s subsidiary Thomas Hedley will market the toothpaste in Britain.

Computer takes over a plant

ELECTRONIC computers, normally thought of as highly sophisticated calculating machines, embark on a new and vital rôle in industry with the news that I.C.I. have ordered a digital computer for the direct control of one of their chemical plants at Fleetwood, Lancs. The computer is the Ferranti Argus machine and it is expected to be working at Fleetwood by June.

I.C.I. took this historic step in plant control when it became necessary to install new instruments on the plant (the nature of which has not been disclosed). They decided to centralise all the control loops in a digital computer rather than install a large number of individual analogue controllers in a conventional system. The digital system costing from £50,000 to £100,000, costs more than the analogue system, but the central availability of all process data offers benefits that make it worthwhile. For example, the process variables will be logged on magnetic tape in such a way as to facilitate mathematical analysis of the plant characteristics in a Ferranti Mercury computer. Knowledge thus

gained will gradually be incorporated in the Argus programme so that, ultimately, the independent control loops built into it will be subject to overall supervision by a master section of the programme. About 100 control devices (loops) will be replaced by Argus, which can perform the prodigious mathematical feat of 50,000 additions or 10,000 multiplications per second. Outputs for controlling the settings of nearly 100 pneumatic valves are also being provided.

The importance of this installation is that the computer works directly on the process. A more orthodox approach would have been for the computer to operate through conventional controllers. Inputs from a mass of measuring equipment all over the plant will be fed directly into the computer and outputs from the computer will directly control actuators and through them the plant. The computer will log data directly by operating a wide carriage typewriter.

It is not to be expected that immediate or large economies will result from the Argus installation. Many chemical plants are so highly automated that it is not an easy matter to improve productivity. That is precisely why a computer is needed. It will enable a mathematical correlation between a number of complex reactions to be arrived at and thus open up the possibility of optimising plant performance. Computers are the last stage in process automation. Ferranti were recently called in to advise on the installation of a computer for an antibiotics plant. They advised against it because the process had not reached a high enough degree of instrumentation. By installing more instruments the manufacturers could increase output and pave the way for ultimate control by computer.

Collick, grief and plague

IN 1665 almost everyone who died in London died of the plague. But not quite everyone; contemporary reports of the parish clerks record the following patterns of death:

Appoplex and Suddenly	116
Bedrid	10
Blasted	5
Collick and Winde	134
Distracted	5
Found dead in streets	20
Grief	46
Gripping in the Guts	1,288
Hangd & made away with themselves	7
Kings Evill	86
Lethargy	14
Murthered and Shot	9
Rising of the Lights	397
Stopping of the Stomack	332
Surfet	1,251
Teeth and Worms	2,614

But nearly 70,000 people died of the plague. Nearly 300 years later a World Health Organisation report shows that infectious diseases have heavily declined as causes of death. Pneumonia, once the prime killer, is now number five. Chemotherapeutics like sulphonamides and antibiotics have powerfully contributed to the defeat of infectious diseases. Looking back at the records of 1665, the debt we owe to Ehrlich, Fleming and their successors, and to the pharmaceutical industry, becomes clear.

A new way of teaching chemical engineers?

TO HELP him plan a course in chemical engineering, Prof. Edgeworth Johnstone, professor of chemical engineering at Nottingham University, sent questionnaires to over 2,600 members of the Institution of Chemical Engineers. They were asked to mark the subjects in a list of 24 that they had personally used during the preceding five working days. Over 70% of the questionnaires were returned—a high percentage. For analysis of the replies the 24 subjects were grouped into six. This is what the replies showed:

Group	*Relative frequency* %
Chemical Engineering Science	42·3
Pure Science	20·0
Social Science	18·4
Communications	10·8
Other Engineering Science	5·1
Higher Mathematics	3·1

From these figures Prof. Johnstone concludes that a chemical engineering curriculum, besides teaching chemical engineering science, must also teach management, economics, communications, etc.

The results seem to justify these conclusions, yet it may also be argued that they show nothing that has not been well known to chemical engineers for 30 years. Chemical engineering practised in industry is a group activity and in common with other group activities entails some familiarity with social sciences; management, economics and report writing are only some of the "non-engineering" activities in which any chemical engineer wishing to attain a position of responsibility must become proficient. Ever since they initiated chemical engineering courses, universities have paid less attention to such subjects claiming (and who can deny it?) that during the very limited time which a student spends in their care they can only try to instil a thorough grounding of engineering fundamentals. Were they to teach the social sciences as well, an honours degree course could easily be extended to 5 to 6 years instead of the usual 3 to 4. Moreover curricula with strong leanings towards industrial requirements have always been taught at technical colleges (now promoted to Colleges of Applied Technology); it is well understood that there is a distinction between university and technical college graduates in aptitude and outlook.

The suggestion, therefore, that universities should teach similar courses as technical colleges would not be acceptable to the university authorities and would be looked at with suspicion by the technical colleges.

Small-scale Processing Machinery

A NEW "MANUFACTURING CHEMIST" SERIES

A great deal of pharmaceutical production is done on a small scale in retail and hospital dispensaries, in research and development laboratories and in factories. There is thus universal interest in small machines, whether for production or development. To help readers choose the most satisfactory machines for their work we have commissioned a series of articles by independent authors who will attempt to discuss critically and objectively commercial equipment for the major processes. We begin with emulsifying machines. Future articles will cover sifting and grinding, drying, powder milling, liquid mixing, solid mixing, filtration and tableting.

EMULSIFYING MACHINERY

By C. W. Ridout,* F.P.S.

THE use of emulsifying machinery in retail dispensaries, hospitals and small experimental laboratories has probably been neglected, in the past, for three main reasons: (*a*) cost, (*b*) reluctance to buy a piece of equipment which can be used possibly infrequently for one purpose only, and (*c*) floor or bench space occupied. Fortunately, however, manufacturers are now offering small pieces of equipment which are capable of being used for more than one purpose and this permits a small laboratory to purchase a versatile machine and to spread its cost over a number of processes. The business which concentrates on one particular type of emulsified product can still purchase a homogeniser or colloid mill of the size most suitable for its scale of operation, but it is hoped that this article will show pharmacists in all fields that there are several different types of machines for making emulsions on a small scale, each having its advantages and disadvantages.

Nature of emulsions

An emulsion consists of two liquid phases, one of which is finely subdivided and dispersed in the other, the system being made more or less permanent by the presence of an emulsifying agent.[1] A liquid dispersed system possesses a large amount of potential energy and it will always tend to break down into its original components. This is in accordance with Gibbs' definition—"an emulsion is only at equilibrium when broken."

The emulsifying agent also reduces the interfacial tension between the continuous and dispersed phases[2] and thus reduces the amount of work that must be done on the system to make it stable. Only in a few cases, however, does the choice of a particular emulsifying agent affect the type of machinery used for emulsification.

The creaming of an emulsion, either upwards or downwards, is dependent upon a number of factors, and Robinson[3] showed that a modification of Stokes's Law of settling permitted an analysis of the settling rate of suspensions. Applying this to an emulsion we have:

$$U = \frac{d^2(\rho_d - \rho_e)}{\eta} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where U = rate of creaming in cm/sec.
d = average diameter of the globules of the dispersed phase in cm.
ρ_d = density of the dispersed phase in G/c.c.
ρ_e = density of the whole emulsion in G/c.c.
η = viscosity of the whole emulsion in poises.

Thus this equation indicates a number of factors which can be varied in order to keep U as small as possible. However, when considering the use of machinery to manufacture an emulsion of a specific formulation the diameter of the globules of the dispersed phase is the only variable and so the object of any emulsifying machine is to make d as small as possible.

Thomas[4] states that the amount of work required to disperse one liquid in another in the form of an emulsion is equal to the product of the interfacial tension and the increase in surface area of the dispersed phase:

$$W = \gamma.\Delta S \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where W = work in ergs
γ = interfacial tension in dynes/cm.
ΔS = increase in surface area in sq. cm.

A sphere of radius r cm. will have a surface area of $4\pi r^2$ sq. cm. and a volume of $\frac{4}{3}\pi r^3$ c.c. Since the surface area of the dispersed phase is very small compared with the surface area of the droplets which are formed from it, then the former area can be considered negligible and the surface area of the droplets may be taken as the total increase in surface area.

Therefore the increase in surface area per c.c.

$$= \frac{4\pi r^2}{\frac{4}{3}\pi r^3} = \frac{3}{r}$$

* Lecturer in Pharmaceutics, School of Pharmacy, University of London.

and if ΔS is the increase in surface area for V c.c.—where V is the volume of the dispersed phase

$$\text{then } \Delta S = \frac{3V}{r} \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Substitute for ΔS in (2)

$$W = \frac{3\gamma V}{r} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Thus if the radius of the globules of the dispersed phase is reduced in order to reduce the rate of creaming, then the amount of work done on the system must be increased. Emulsifying machines are the means whereby energy is put into the system in order to achieve this object.

Types of machine

There are four main types of machine for making emulsions: high-speed stirrers and mixers of various kinds; homogenisers; colloid mills; and ultrasonic emulsifiers. (The distinction between homogenisers and colloid mills is based on the means whereby emulsification is produced, rather than on the type of end-product produced.)

High-speed stirrers

These machines provide an easy means, even on a comparatively large scale, of manufacturing simple emulsions and are also useful for preparing a premix or coarse emulsion prior to passage through a colloid mill or homogeniser. Since the purpose of mixing is to disperse one phase in another, care must be taken to ensure conditions of turbulent flow in the system.[5,6] This is attained, in some cases, by providing two impeller blades on the same shaft so that the bottom rotor forces the liquid upwards and the top rotor forces the liquid downwards. Where a shaft has only a single impeller the positioning of the stirrer in the liquid must be such that the formation of a vortex is avoided to prevent air being sucked into the liquid. Aeration may be objectionable because of oxidation,[7] denaturing of proteins or the production of unwanted bulk in the final preparation. On a small scale a glass rod or spatula placed near the wall of the vessel so that it acts as a baffle is usually sufficient to prevent vortex formation.

Since much greater forces are needed for emulsification than for mixing, high speeds are essential but this tends to produce a large amount of aeration unless special precautions are taken.[8]

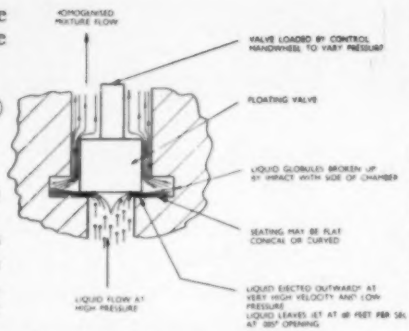
HOMOGENISED MIXTURE FLOW
VALVE LOADED BY CONTROL HANDWHEEL TO VARY PRESSURE
FLOATING VALVE
LIQUID GLOBULES BROKEN UP BY IMPACT WITH SIDE OF CHAMBER
SEATING MAY BE FLAT CONICAL OR CURVED
LIQUID EJECTED OUTWARDS AT VERY HIGH VELOCITY AND LOW PRESSURE
LIQUID LEAVES JET AT 60 FEET PER SEC AT .005" OPENING
LIQUID FLOW AT HIGH PRESSURE

Fig. 1. Q.P. Homogenising Jet (Ormerod Engineers Ltd.).

High-speed stirrers are inexpensive and useful for pharmaceutical processes other than emulsions. They are easy to clean and maintain and require little supervision. They are very useful for emulsions of low viscosity and possibly their greatest advantage is that both phases can be mixed together in one vessel, avoiding the necessity of a final mix. Their disadvantages are that they tend to produce rather coarse emulsions which may cream rapidly. High-speed stirrers are not suitable for gelatin and similar viscous emulsions.

The whisk is a development of the high-speed stirrer. It can produce considerable shear forces in the liquid as well as mixing the final preparation. Owing to their design it is almost impossible to prevent air being whipped into the emulsion.

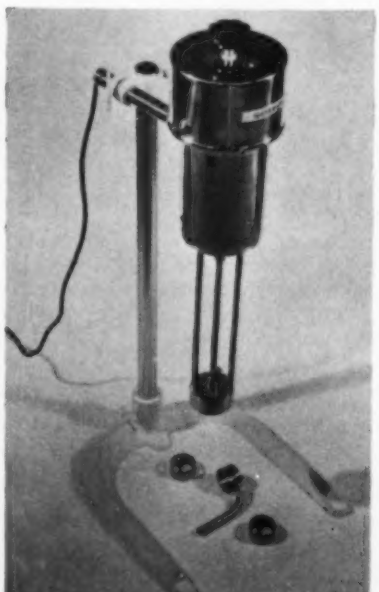

Fig. 2. Laboratory mixer (Silverson Machines (Sales) Ltd.).

Homogenisers

In 1903 Gaulin[9] patented a machine for forming an emulsion by forcing a mixture in a continuous stream under pressure between a conical valve and a seat similar in shape, the valve being held in place by a heavy spring exerting a pressure of 250 kg.-350 kg. per sq. cm. This machine was the forerunner of the modern homogeniser.

Fig. 1 shows the arrangement of the homogenising jet in the Q.P. machines. The liquid is sucked into a hollow chamber on the upward stroke and on the downward stroke it is forced under pressure between the valve faces, where it undergoes shear and the globules are further broken up by impact with the sides of the valve chamber.

The hand - operated cream machines are suitable for dealing with small batches of fluid and semi-fluid emulsions. Johnson and Morse[10] have shown that these small machines can produce emulsions comparable with those prepared by larger homogenisers.

The design of the hand and machine operated homogenisers is such that the working parts are easy to clean. The machines need very little adjustment and worn valves are cheaply and quickly replaced. The feed to homogenisers should at least be a coarse emulsion. Recycling of the emulsion decreases the particle size, thus improving the stability.

Most homogenisers, whether hand or power operated, tend to give an aerated product because air is sucked back into the emulsifying chamber during the filling stroke. Homogenisers are more suitable for fluid emulsions and very soft creams.

Colloid mills

These mills consist basically of a stator and a rotor whose speed may vary from 1,000 to 20,000 r.p.m. The emulsion passes between the faces of the rotor and stator, the gap between them being either continuously variable or variable by fixed amounts. Stationary films of liquid are adsorbed on to the working surfaces of the rotor and stator and considerable shear forces are exerted between these films at high speed.

In some types of colloid mills the emulsion may pass through the machine under the action of cen-

Fig. 3. Laboratory stirrer (L. A. Mitchell Ltd.).

trifugal force, in which case the time the emulsion spends between the shearing surfaces is determined chiefly by the speed of the rotor. In other cases the rate of passage through the machine can be controlled by altering the head of liquid flowing in or by adjusting the output rate.

Colloid mills can be subdivided into four groups: (*a*) smooth-surface mills; (*b*) rough-surface mills; (*c*) corrugated-surface mills and (*d*) beater mills.

(*a*) **Smooth-surface mills.** In these machines both the rotor and stator are smooth and parallel to each other. Emulsification is caused by shearing forces induced by the relative motion of the rotor and stator.

(*b*) **Rough-surface mills.** The rotor and stator are parallel to each other, but the working surfaces are roughened and usually made of carborundum. The roughened surfaces will produce turbulence in the liquids flowing between them, thus aiding emulsification, and, in addition, these surfaces are useful for grinding the solid components in a formulation and processing the more viscous creams and pastes.

(*c*) **Corrugated-surface mills.** The rotor and stator are corrugated and not parallel to each other, the working distance between the two decreasing from a maximum at the central axis to a minimum at the periphery. In addition to this, the flow of material rapidly changes direction because of the corrugations and consequently both shear and impact forces operate in the mill. Centrifugal force carries the liquid through the mill, but, owing to the changes in angles of the inclined working surfaces, this force is considerably reduced, thus slowing down the rate of flow. Because of the corrugations the surface area of the working surfaces is increased and this, together with the slower rate of flow, increases the time of treatment of the material in the mill.

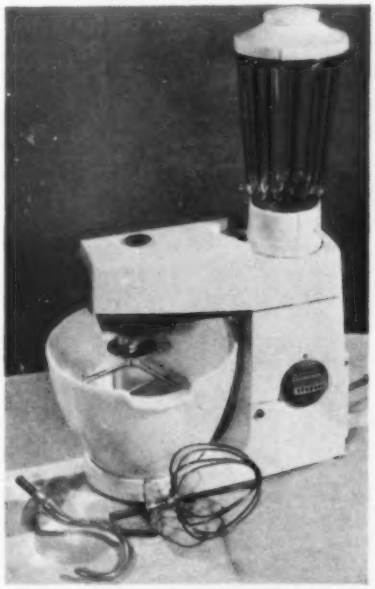

Fig. 4. Kenwood Chef (Kenwood Electrics Ltd.) showing K-type mixer mounted in the bowl, dough hook, basket-shaped whisk and liquidiser mounted on top of the machine.

(*d*) **Beater mills.** Plauson[11,12] obtained the first patents on this type of mill, but a number of improvements have been made since. In the Plauson mills the globules are subjected to shear and impact forces by beaters consisting of revolving blades passing between fixed blades. Recent improvements incorporate a corrugated rotor and stator together with beaters.

Colloid mills generally are capable of dealing with both liquid and viscous emulsions and even pastes. Providing the inlet and outlet pipes are kept full, aeration need not be a serious problem except at the beginning and end of a batch. Aeration is less of a problem in the corrugated mills because of the slower rate of flow of the liquid between the milling surfaces.

Cleaning and maintenance present few problems, but some preliminary work may be required in determining the optimum size of gap, speed (if this is variable) and flow rate before the best results are obtained.

The choice of a homogeniser or a colloid mill for the preparation of a complex or difficult emulsion may depend upon a number of factors, but it may be necessary to consider the effect of solid particles on pistons, valves and valve-seatings before choosing a homogeniser in preference to a colloid mill. In general liquid/liquid emulsions are equally well prepared by either type of machine, but the colloid mill is better suited to preparing solid/liquid emulsions and the more viscous emulsions.

Ultrasonic emulsifiers

It is usual to divide acoustic vibrations into two groups—audible sound (frequencies below 10-20 kc./sec.) and inaudible sound or ultrasonics (frequencies above 20 kc./sec.). The laws of audible sound are applicable to the ultrasonic region, and if a liquid is subjected to ultrasonic vibrations alternate regions of high and low pressure are formed. In the low pressure regions the liquid is torn apart with the formation of hollows or cavities. These cavities become filled with the gases normally dissolved in the liquid, and when the cavities collapse local areas of extremely high pressure are formed. Providing the liquid has not been degassed, then cavitation produces sufficient turbulence to break up one liquid and disperse it in another.

Campbell and Long[13] investigated emulsification by ultrasonics at low frequencies (15 kc./sec.) and at high frequencies (1 mc./sec.) and suggested that ultrasonic vibrations increase the relative movement of the dispersed particles and therefore increase the rate of coalescence and subsequent cracking of the emulsion. They also suggested that ultrasonic cavitation in a liquid disrupts it into small droplets and disperses them. This latter action would favour emulsification. These opposing actions are always present and experiments showed that lower frequencies favoured emulsification and higher frequencies demulsification.

Ultrasonic waves can be produced by a number of methods, the most important being (*a*) the Pohlmann whistle generator producing oscillations up to about 30 kc./sec.; (*b*) the magnetostriction generator operating up to about 50 kc./sec., and (*c*) the piezo-electric generator which seldom operates below 50 kc./sec. and usually in the range of hundreds of kilocycles per second.

(*a*) **The Pohlmann Whistle Generator.** This apparatus[14] consists of a thin blade on to which is forced a jet of liquid at a high pressure. The blade vibrates at its natural frequency and the oscillations are transferred to the liquid.

The smallest quantity of liquid that can be dealt with by this type of generator depends upon the size of the pumps which deliver the liquid at high pressure and the lengths of the feed pipes.

(*b*) **Magnetostriction Generator** and (*c*) **Piezo-electric Generator.** These two types of generators are much smaller instruments and unlike the Pohlmann Whistle type are able to deal with a few millilitres of liquid at a time. Maintenance and cleaning involve no serious problems apart from the fragility of the crystal in the piezo-electric type.[15] The initial cost can be high. The output rate is very low.

COMMERCIAL EQUIPMENT

1. High-speed Stirrers

Silverson mixers

This machine consists of a powerful centrifugal suction pump enclosed in interchangeable heads and meshes. By means of these various heads the machines can be used as homogenisers, mixers, pumps and as a disintegrator for animal tissues, fruits and vegetables.

When used as a homogeniser the emulsor head is fitted; it consists of a

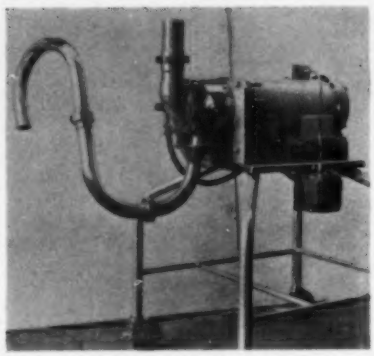

Fig. 5. Homonutor No. 151 (Apex) fitted with U-bend delivery tube.

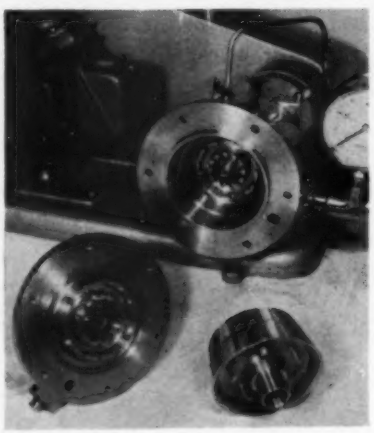

Fig. 6. Chamber of Homonutor No. 151 fitted with hedgehog type rotor. All parts in contact with the liquid are in stainless steel.

circular mesh which fits around the rotor blades of the pump. The pump sucks the liquid in axially and throws it out tangentially at a high speed through the finely meshed emulsor head. Impact and shear forces operate to produce a fine globule size.

This machine is essentially one for a batch process, but it has the great advantage that scaling-up presents no formulation problems as the larger machines operate on exactly the same principle, using a larger motor. Without careful adjustment of the position and angle of the mixer in the liquid, aeration can be induced. The head surrounding the rotor can be quickly changed and the emulsion pumped into a container at a rapid rate.

The laboratory mixer (Fig. 2) can handle as little as 8 fl. oz. of liquid and up to 2 gal. The motor, controlled by a rheostat, gives a range of speeds, under load, from 200 to 8,000 r.p.m. At all speeds the machine is smooth and free from vibration. The rotating shaft has a rigid bearing near to the rotor blades, consequently it is not subject to "whip" even after continual use.

Laboratory mixers

A laboratory mixer is only satisfactory for making emulsions if a sufficiently large motor is provided to give the necessary shear to break up the dispersed phase. A relatively robust machine should therefore be selected and a $\frac{1}{8}$ h.p. variable speed mixer suitable for this duty is shown in Fig. 3. This Mitchell laboratory stirrer incorporates a pistol grip type handle so that it can be removed from the adjustable stand and used independently in a larger container if necessary. A selection of impellers is available to deal with emulsions of varying viscosities. The speed of the motor can be controlled from a few revolutions per minute up to 2,500 r.p.m. Half a pint of liquid can be dealt with by this size of mixer and larger models can be obtained for increased quantities. The use of baffles will help in producing a suitable emulsion, but aeration can occur especially with small batches of liquid.

The Premier "Dispersator"

This consists essentially of a slotted drum rotating at high speed. The resulting centrifugal force draws the liquid through the bottom of the dispersator and forces it out through the slots in the wall of the drum. The extreme turbulence thus produced breaks up the liquid into small droplets by shear and impact. Used in conjunction with a baffle, as indicated earlier, the machine will quickly produce a good emulsion, particularly if the final product is fluid and not viscous. In common with all simple mixers it tends to incorporate a lot of air in the emulsion.

The whisk

This is a piece of kitchen equipment that has been successfully adapted for use in the laboratory as a mixer and emulsifier. The Kenwood Chef (Fig. 4) incorporates a whisk among its auxiliary equipment, and providing the inclusion of air into the emulsion is not a drawback, the whisk will produce a satisfactory emulsion. The basic motion of the whisk in the Kenwood Chef is planetary, and superimposed on this

is the rotary movement of the whisk itself. This ensures movement throughout the whole of the liquid, and although it beats a large amount of air into the mixture it will produce an emulsion in a very short time. The mixing bowl is made of toughened glass or stainless steel.

The machine also incorporates a liquidiser. This is a high-speed mixer which can be used as a disintegrator as well as a homogeniser. Quantities of up to one pint of liquid can be used in the liquidiser, and being totally enclosed there is no loss of liquid due to splashing, but like the whisk it aerates the emulsion.

The " Homonutor "

The Apex No. 151 homonutor (Fig. 5) is designed for a number of pharmaceutical operations and only a few adjustments are necessary to change from liquid to solid processing.

When used as an emulsifier the homonutor consists of a chamber in which rotates at high speed a rotor of a hedgehog type consisting of a large number of stainless steel pins (Fig. 6). The material to be processed is forced by this rotor through screens which are easily interchangeable. Dispersion is caused by intense shear forces set up by the rotor which has a very large surface area, and by impact forces as the mixture strikes the screen mesh. Some dispersions tend to produce large aggregates of globules of the dispersed phase after emulsification. Such a system would be broken up by its passage through the screen giving a fine emulsion which would cream much less rapidly. The rate of flow of the dispersion through the emulsion chamber can be controlled by a plug cock at the base of the conical feed hopper, and by fitting a finer mesh screen the emulsion may be retained in the chamber and so subjected to shearing forces for a longer period of time. Feed back of air into the homogenising chamber can be reduced, if not eliminated, by the attachment of a U-bend delivery tube.

The homonutor will operate on 2 pints of liquid, but larger quantities reduce aeration of the product. Thick liquids and pastes can be handled, in which case a screw-feed hopper replaces the normal conical hopper.

This machine can also be used for grinding and mixing powders, drugs and granules. The change-over from the hedgehog rotor to a swinging blade rotor is simple and rapid and a stainless steel feed pan replaces the hopper.

Fig. 7. Standard Q.P. laboratory emulsifier (Ormerod).

The standard rotor speed is 3,000 r.p.m., but machines running at other fixed speeds are available and in addition two- and three-speed machines are obtainable.

2. Homogenisers

Q.P. laboratory emulsifier

This is a hand-operated machine (Fig. 7) capable of dealing with up to one pint of liquid. It emulsifies by forcing the liquid through an adjustable valve, as described previously.

Pressures up to 2,000 p.s.i. are claimed by the manufacturers. An alternative jet is available, consisting of a fine orifice through which the liquid is forced and then thrown against a baffle. This type of jet is suitable for liquid/liquid emulsions but not for those which contain solid particles.

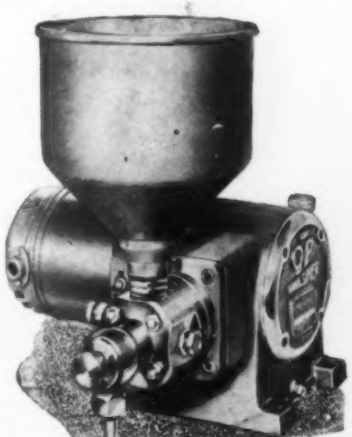

Fig. 8. Q.P. Blue Calf homogeniser, fitted with 1 gal. hopper (Ormerod).

The Q.P. Blue Calf homogeniser (Fig. 8) uses the same homogenising jet as the hand-operated machine, but is designed for larger quantities (up to 1 gal.). In this case an output of about 10 gal. per hr. is claimed at pressure up to 1,000 p.s.i. Five-gallon tanks, jacketed or plain, with or without high-speed stirrers are available for direct connection to the machine.

Cleaning and adjustment are easy and the hopper can be replaced by a pipe for continuous feed.

Bel cream maker

This is an inexpensive, hand-operated, domestic type cream maker. Its capacity is about 10 fl. oz. The valve is adjustable and successful homogenisation may require the liquid to be passed through the machine more than once.

3. Colloid Mills

Hurrell homogeniser

There are two types, differing principally in the way in which the ingredients are (i) fed to the machine, (ii) propelled through the gap, and (iii) discharged.

In type " C " (Fig. 9) the gap between the rotor and the stator is horizontal and parallel to the axis of rotation. The size of the gap is varied by changing the rotor. The feed is along the main axis of the motor and the mixture passes radially to the periphery through the shearing gap and is discharged from the top of the machine via a control valve. Since the homogenising gap is parallel to the axis of rotation, there is no centrifugal force acting on the emulsion in the gap, thus the flow-rate depends upon the hydrostatic head of the input feed and the setting of the output control valve. This control must be set carefully as it is possible to retain the emulsion between the gap for a period long enough to raise its temperature, causing loss of the more volatile phase by evaporation and in extreme cases cracking of the emulsion.

In type " B " (Fig. 10) the gap is set at a slight angle to the axis of the rotor and the clearance is continuously variable by adjusting the position of the rotor relative to the fixed stator. Centrifugal force carries the liquid through the gap and the emulsion is discharged via the outlet pipe at the base of the machine.

In both types of machine the peripheral speed of the rotor is reasonably constant — 9,000 to 10,000 ft. per min., this being the most suitable speed for fluid aqueous emulsions. Each type of machine is made in three sizes and the speed of the rotor is adjusted to give this constant peripheral speed.

Both machines are easy to clean and maintain and the rotor in type "C" can be changed quickly.

Both types of machine are suitable for large-scale batch or continuous processes. Aeration can be a problem in small batches.

Premier high-speed conical mill

The emulsifying action of this mill (Fig. 11) is very similar to the type "B" Hurrell homogeniser. The feed is along the main axis of the motor as before and centrifugal force thrusts the liquid between the working surfaces (WS) of the rotor (R) and stator (S). The clearance between the rotor and stator is adjustable from 2-3 thousandths of an inch up to 20-30 thou. by means of an adjusting ring (AR). The emulsion leaves the machine via the outlet pipe (VO) at the bottom of the stator.

The peripheral speed in the Premier mill is a little higher than in the Hurrell machine—from 12,000 to 14,000 ft. per min., approximately, depending upon the capacity of the machines. Mills are available to deliver from 25-1,500 gal. per hr. The higher peripheral speed enables these mills to deal with emulsions containing solids rather better than the slower speed machines, but they are not so suitable for the more viscous type of emulsion.

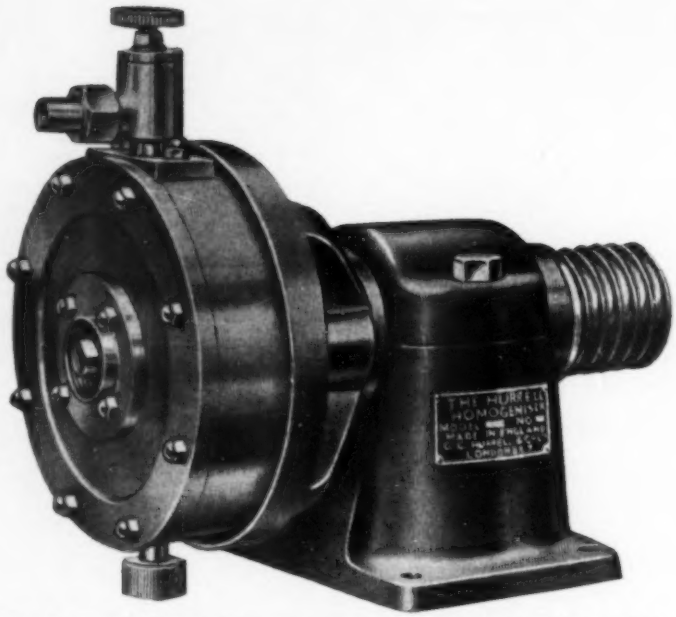

Fig. 9. Type C Hurrell homogeniser (G. C. Hurrell and Co. Ltd.).

Pastes and similar emulsions are more conveniently processed in the slower speed Premier paste mill. This is a vertical machine and the working surfaces can be either stainless steel or carborundum. In the former case the mill can be fitted with a water jacket for cooling or for maintaining a constant temperature between the working surfaces. The carborundum mills are fitted with a stone re-centering device to overcome uneven wear of the stones. Adjustment of the gap between the rotor and stator is the same as in the high-speed conical mill, and the feed is by gravity except that for very thick pastes a force feed hopper can be fitted. The smallest model in this series has a 5 in. rotor with an output of 3-5 cwt. per hr.

A much smaller machine made by the same firm is the "multipurpose" colloid mill (Fig. 12). It occupies only 3 sq. ft. of bench space and can be fitted with either stainless steel or carborundum working surfaces. The gap between the rotor and stator can be altered by means of an adjusting ring. Centrifugal force carries the dispersion through the gap and projects it on to a baffle, thus utilising both shear and impact forces. The capacity of the hopper is 7 pints, but as the diameter of the rotor is only 3 in. it is possible to use quantities down to 4 fl. oz. with a reasonably small loss. The totally enclosed motor, fitted on the same base-plate as the homogeniser, has two speeds, 8,000 and 12,000 r.p.m., and the rotor speed can be further varied by the use of suitable pulleys. There is no control either on the input or the output apart from

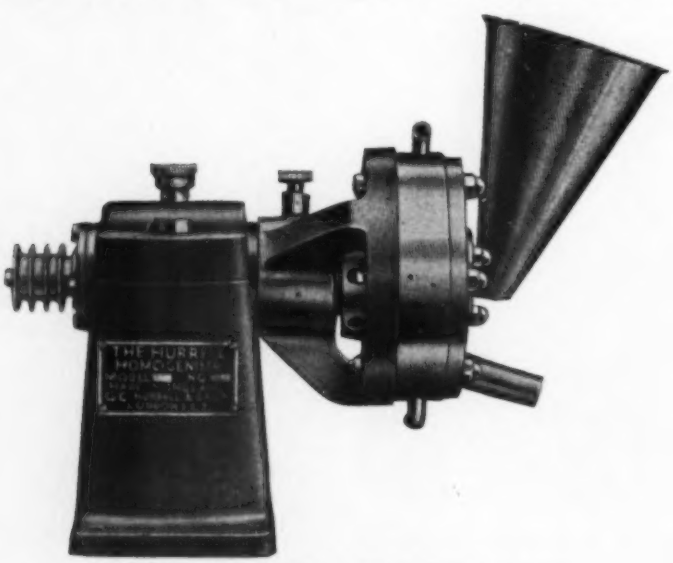

Fig. 10. Type B Hurrell homogeniser.

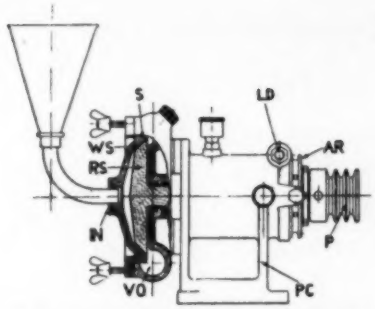

Fig. 11. High-speed conical mill showing (R) rotor, (S) stator, (AR) adjusting ring, (VO) outlet and (WS) working surfaces (Premier Colloid Mills).

decreasing the size of the gap or speed to slow down the rate of flow.

High-speed corrugated mill

The working surfaces of the Premier machine (Fig. 13) have "V"-shaped corrugations, the angles of which are designed so that the cross-sectional area of the space between the grinding surfaces at the periphery can be made equal to or less than the cross-sectional area of the space at the centre. Thus it is possible to keep the whole of the space between the rotor and the stator full of liquid and also to maintain the liquid under pressure. This arrangement is attained by reducing the clearance between the working surfaces as the liquid passes from the centre to the periphery, and this ensures that the globule size of the dispersed phase is progressively reduced as the liquid passes through the machine and that air is not sucked in through the outlet pipe since the gap is full of liquid under pressure.

The output per hour from the corrugated mill is lower than that from a similar size machine with smooth working surfaces, but since the smallest Premier corrugated mill has a rotor diameter of 5 in., and an estimated output of 40-100 gal. per hr., it would probably be too large for small-scale operations.

Fig. 12. "Multipurpose" colloid mill (Premier Colloid Mills).

Apex-Sergeant colloid mill

This mill (Fig. 14) uses beaters and corrugated surfaces to produce a fine emulsion. It consists essentially of a chamber containing a high-speed rotor and a stator. The mixture enters the mill through the centre of the rotor which is hollow and which incorporates cast vanes on its inside vertical face. These vanes are similar to those of a centrifugal pump and force the liquid outwards, by hydraulic pressure, between the rotor and the stator. The clearance between the rotor and stator is continuously variable from 0·001 in. upwards. After leaving this shearing zone the material is forced in the form of a ribbon through slots into the beater tracks or space where violent turbulence is produced by the beaters. The beaters are in the form of pegs shaped so that cavitation occurs behind them, causing the dispersed phase to break up and emulsify. The liquid then flows centripetally and is discharged on the centre line of the machine under high pressure. Intense shearing and impact forces operate throughout the machine, and aeration of the product is eliminated by controlling the rate of flow of the emulsion by opposing the centrifugal force by the centripetal force.

The mill is available in three sizes—3 in., 5 in. and 10 in.—with outputs varying from 300 to 3,000 gal. per hr. The 3 in. model is quite suitable for research or small-scale production. The mills can be provided with water-jackets in order to process heat-sensitive materials. Cleaning is easy. The gap between the rotor and stator is adjusted by a screw thread and the actual clearance is shown on a calibrated scale.

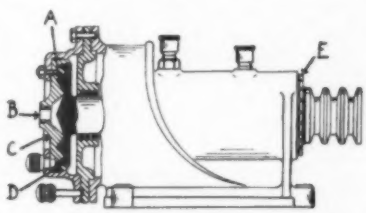

Fig. 13. Sectional view of high-speed corrugated mill. (A) Rotor, (B) inlet, (C) stator, (D) volute, (E) clearance adjusting ring (Premier Colloid Mills).

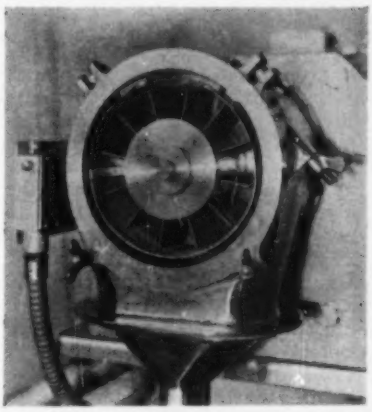

Fig. 14. Apex-Sergeant colloid mill model 270B. The chamber is dismantled showing the rotor with its beaters and the slots in the periphery through which the material is discharged. The chamber housings show the angled slots in the beater tracks.

4. Ultrasonic Emulsifiers

Minisonic model 3 emulsifier

This Pohlmann Whistle type uses a blade which vibrates at 18-22 kc./s. The design (Fig. 15) is such that emulsification can be carried out under a number of controlled conditions. The apparatus consists of two heat-resistant

(Continued on next page)

Fig. 15. Minisonic emulsifier, Model 3 (Ultrasonics Ltd.). This is a Pohlmann whistle type using a blade which vibrates at 18-22 kc./sec. This design allows emulsification to be carried out under a number of controlled conditions.

(*Continued from previous page*)

glass vessels connected via a 3-way control valve to a pump. The output from the pump is fed through the vibrating element to a swivel discharge pipe. If the disperse phase is placed in one vessel and the continuous phase in the other, the three-way tap allows the operator to mix the liquids in predetermined proportions before they pass the vibrating element. If a premix is put in one vessel the emulsion can be fed into the other, and by altering the control valve the emulsion can be readily recirculated as often as desired. Each glass container holds 3 litres, but smaller quantities of liquids are easily and quickly handled. All parts of the emulsifier in contact with the liquid to be emulsified are made either in 18/8 stainless steel or corrosion-resistant materials, and the apparatus is easily dismantled for cleaning using the tools provided.

Singiser and Beal[16] evaluated the Minisonic emulsifier, using mineral, peanut and safflower oils, and concluded that the manufacturing procedure used had very little effect on the final emulsion and that prolonged passage through the machine did not cause coagulation of the emulsion. They also compared[17] it with two other ultrasonic generators and a colloid mill and found that the Minisonic produced emulsions distinctly superior to those made with the other types of apparatus.

The Minisonic model 3 can deal with high viscosity emulsions and the pump can be modified if abrasive powders are used in the formulation.

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Selling Chemicals to the Russians

By Edward Gurr, F.R.I.C., F.L.S., F.R.M.S.

At a recent meeting of the Association of British Chemical Manufacturers, Mr. Gurr gave a paper on exporting to Russia. It was based on his own experience as the proprietor of a business manufacturing microscopic stains. Here is part of his paper. We printed his impressions of the Russian people in December (*pp. 540-41*).

HOW does the small chemical firm set about securing orders from Russia?

First of all write to the Exports Promotion Department, Board of Trade, Lacon House, Theobalds Road, London, W.C.1. Tell them exactly what kind of chemicals or other products you want to sell to the Soviet Union and ask them for the name and address of the organisation in Russia which deals with the import of your particular products. Then write to that organisation. Not enough of our members make enough use of the Board of Trade. Too many people are too ready to criticise the Board. I have always found them most efficient and obliging and willing to help. You only have to ask them. That's what they are there for.

If you don't get a reply back from Russia within four or five weeks, write again. And keep on writing until you do get a reply. You will get one in the end, but it might take a little time. When you get a reply, write again and say you will be in Russia soon and would like the pleasure of calling on them while you are there to discuss matters of mutual interest. Meanwhile make arrangements with your travel agents to visit Moscow and other places in the Soviet Union. Just tell them what cities you want to visit and they will make all the necessary arrangements for you.

When you get the reply from the government importing organisation in Moscow and they say that they will be pleased to see you, acknowledge it and give the approximate date you expect to call on them. If the reply is that they don't want to see you, and if you are still keen, go just the same and pay them a *surprise* visit. They are almost certain to see you, especially if you can't speak Russian. They are particularly helpful to a foreigner who can't speak their language. You need not worry about that. There will be an interpreter. English is taught in all schools, and a large percentage of the population speak it. Most educated people in the Soviet Union speak English. You need not feel flattered about that, as I was, until I found out that they learn English to enable them to keep abreast of America!

When you get your interview with the Russian official, try gentle sales talk. Don't try to be a high-pressure salesman. It is undesirable in any country, I think. One does not make friends that way. A customer is a friend, remember. If they are satisfied with their present suppliers, well and good, but you happened to be in Russia and you felt you would like to make the gentleman's (or lady's) acquaintance. Then get the conversation round to personal and family affairs, just to show him or her that you too are only a human being the same as he or she is.

Don't talk politics, of course! My impression was that the Russian people are not very interested in politics. Their form of government suits them, and that's their affair; whether you are a communist, an anarchist or an out-and-out conservative doesn't interest them in the least. If you listen to your host you are sure to learn something which will have been worth your while going to Russia for. In any case it will be education!

When you get back to your office in Manchester, or wherever it happens to be, write and thank your Russian host, and say that you hope that they will give you an opportunity of quoting when they are next in the market for your products. If you don't get any enquiries within a few weeks write again, and keep on writing until you do! But the chances are that the enquiries will come in soon after you return from Russia. Then it's up to you to get out the quotations quickly. If you don't get the order, write again and ask why. If you don't get a reply, write again. Eventually you'll hear from them. Don't give up easily.

Management Efficiency in the Pharmaceutical Industry

HOW INTERFIRM COMPARISON CAN HELP

By H. Ingham*

Interfirm comparison (IFC) enables a company to compare its management efficiency with similar companies. A scheme is now being prepared for the British pharmaceutical industry and firms wishing to participate should write to the address given at the end of this article in which IFC is explained.

1. The need

Is your return on capital satisfactory?
Are your selling costs too high?
Is your stock turnover adequate?
What about your production efficiency?
Is your ratio of current assets to current liabilities sound?

There is no managing director who would not be seriously preoccupied with these and similar questions which are of vital importance to his business.

Up to a point he could answer them by comparing his current figures (ratios) of "profit/capital employed"; "selling costs/total costs"; stock turnover; productivity, etc., with those of previous periods, or with the standard or target ratios worked out internally in the course of preparing the firm's budget.

But although such comparisons may appear to show progress, they do not indicate whether the target set or the results obtained are as satisfactory as those of other similar competing companies.

There are in fact many firms which were shaken out of their complacency when they discovered that their key ratios, though they had improved from year to year, compared very unfavourably with those of some of their competitors.

2. The method

But how did these firms manage to gain access to the "vital statistics" of their competitors? The answer is: through taking part in a confidential and anonymous pooling of ratios such as those mentioned above. In many countries and industries this pooling is arranged by independent organisations which are trusted by all concerned to safeguard the confidentiality of the data contributed to them, and which are qualified to undertake certain key tasks:

(*a*) to select the ratios that are most indicative for a particular purpose;
(*b*) to ensure that the data of firms are comparable, *i.e.* based on uniform definitions of terms, uniform accounting procedures, and related to the same accounting period;
(*c*) to present to the firms taking part a comparative picture helping them to detect where in their business improvements should be made if competitive standards of performance are to be achieved or maintained;
(*d*) to assist participants in drawing useful conclusions from differences between their figures and those of their competitors.

This organised and confidential pooling of data, which is conducted as a service to participating firms, is called Interfirm Comparison for Management. In this country a special organisation for the conduct of interfirm comparison (IFC) has been established by the British Institute of Management in association with the British Productivity Council. It is called the "Centre for Interfirm Comparison."

3. Can one really compare firms?

There are people who say: "Like should be compared with like; no two firms are really alike; therefore IFC's are useless." Is this true? Are IFC's ruled out unless the firms are all of the same size, make the same products in the same way, operate in the same locality, employ the same kind of plant, use the same methods of distribution, etc.?

The answer to this is that the object of IFC is not to compare "firms" as such, but to reveal what effect certain differences in their features and practices have on their performance (as reflected, for example, in profits and costs, sales, output, productivity). In fact if there were no differences between the firms taking part they could learn nothing from the comparison.

What people really mean when they raise the question of comparability is that firms should be *sufficiently* comparable for useful conclusions to be drawn from comparisons of their figures. From this it follows that the degree of comparability required can only be decided when it is known what sort of conclusions the comparison is intended to provide—in other words, what its objects are. It is therefore not advisable to generalise on this point. But practical experience shows that it is possible to meet the requirements for comparability in many situations.

4. This is how IFC works

An example from the U.S. pharmaceutical industry

An American pharmaceutical company has taken part in a comparison conducted to provide the top management of participating firms with information of particular relevance to that level of management (not covering matters of detail which are usually delegated to departmental managers). A general management comparison of this kind would be concerned with the success of the business as a whole, and would therefore provide:

* Director, Centre for Interfirm Comparison Ltd.

(*a*) a primary ratio indicating the profitability of the operations of the businesses taking part;
(*b*) a few additional ratios selected to help participants in narrowing down systematically possible major reasons for differences in their primary ratio.

To start with, let us look at some of these ratios for the firm which is taking part in this top management comparison. Table 1 shows a set of seven such ratios.

This looks like a success story:

Profit on assets employed has gone up from 6·22% to 7·51% because an increase in the firm's ratio of profit/sales (ratio 2) more than counteracted a decline in its use of assets (ratio 3). The higher profit margin has been achieved through a reduction in the ratio of production cost of sales/sales (ratio 4) and despite an increase in the ratio of "other costs"/sales (ratio 5). The slow down in asset turnover (ratio 3) does not seem to be in the use of current assets (ratios 6 and 7), so is presumably in the utilisation of fixed assets, such as plant and machinery.

Therefore on the basis of this comparison between this year's and last year's ratios our director will probably try to bring his asset turnover back to its original level and to prune his "other costs," but he will most probably be quite satisfied with the progress made by his firm. But after comparing his ratios with those of other firms in his industry (Table 2), he will be much less complacent.

This year the firm's profit on capital is below the industry average; in fact, it has not yet reached the average achieved by the industry last year.

How do the other ratios help our director to narrow down reasons for this unfavourable comparison?

His firm's ratio of profit/sales (ratio 2), although it has improved, is well below the industry's average; on the other hand, he is probably surprised to find that his turnover of assets (ratio 3), which he thought was in need of improvement, compares favourably with the average for the industry. A possible reason for the lower profit/sales ratio is indicated by ratio 4: our firm's ratio of production cost of sales/sales is very much higher than that of the average of the industry. It has improved, but so has the industry's average. Actual reasons for his high production cost ratio might be shown by an interfirm comparison of ratios relating various cost elements to the sales value of production.

Table 1. A success story?

Ratio	*Last year*	*This year*
1. Profit before tax / Assets employed	6·22%	7·51%
2. Profit before tax / Sales	2·08%	2·74%
3. Sales / Assets employed	2·99 times	2·74 times
4. Production cost of sales / Sales	64·97%	61·97%
5. All other costs / Sales	32·95%	35·30%
6. Sales (at cost) / Average stocks (at cost)	5·46 times	5·46 times
7. Average of outstanding debts / Average sales per day	36 days	37 days

Table 2. Reality. Comparison with competitors

I	*II*	*III*	*IV*	*V*	*VI*
Ratio	*Unit of measurement*	*Averages of ratios of pharmaceutical manufacturers*		*Firm's own ratios*	
		Last year	*This year*	*Last year*	*This year*
1. Profit before tax / Assets employed	%	9·79	14·75	6·22	7·51
2. Profit before tax / Sales	%	4·37	7·06	2·08	2·74
3. Sales / Assets employed	times	2·24	2·09	2·99	2·74
4. Production cost of sales / Sales	%	58·38	53·35	64·97	61·97
5. All other costs / Sales	%	37·25	39·59	32·95	35·30
6. Sales (at cost) / Average stocks (at cost)	times	4·32	3·69	5·46	5·46
7. Average of outstanding debts / Average sales per day	days	39	38	36	37

The director, who after his earlier complacency is now thoroughly alerted, would probably be right in assuming that he need not search for weaknesses in the utilisation of assets, but that he should concentrate his attention on reducing production costs.

The example quoted is from an American comparison. In an IFC conducted by the Centre for Interfirm Comparison further supplementary ratios would be compared, separate results would be presented for each section of the industry, and the range of figures on either side of the average would be shown. Where possible, ratios of individual firms would be tabulated under code numbers.

If the director wishes to have prescriptions for action which are more precise than he can obtain by comparing his *general* management ratios with those of others, he should in the first place consult the organisation conducting the comparison which, on the basis of its knowledge of the underlying conditions of all firms taking part, may be in a position to give him further advice without breaking any confidence. He can also leave it to those responsible for matters of detail within his firm to probe more deeply into the area of weaknesses shown up by the comparison, and to suggest improvements; he can enlist the help of management consultants; or he can let his firm take part in a further IFC covering indications of production efficiency and stock management.

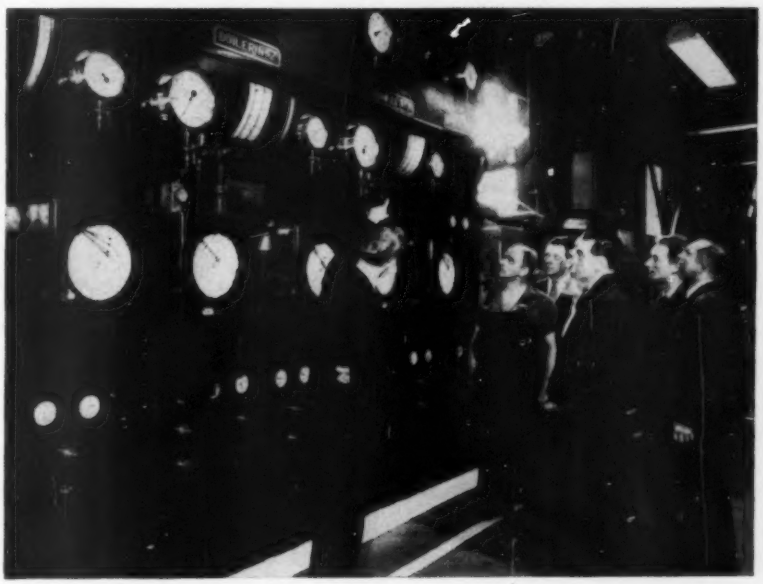
To sum up: participation in this general management comparison has shaken our director out of his complacency and stimulated him to search for weaknesses in his business; it has guided this search in the right direction and thus prevented him from giving priority to investigations of less immediate urgency. This is a

(*Continued on page* 118)

How the Chemical Industries Can Save 1·4 Million Tons of Fuel a Year

By W. Short,* B.Sc.

Extensive studies by the National Industrial Fuel Efficiency Service show that the chemical process industries, which use each year 7 million tons of coal or its equivalent in other fuels, could save nearly one-fifth with better equipment and better process heat utilisation. Far too many boiler plants and steam distribution systems are out of date. In this article Mr. Short proves that fuel efficiency is a better investment than playing the Stock Exchange.



Boiler operator training. An instructor explaining to students types of instruments in the boilerhouse and each one's functions.

THE chemical process industries in the United Kingdom use about 7 million tons of coal, or its equivalent in other fuels, each year, and about 60% of this is used to generate steam for process and heating. N.I.F.E.S. have carried out surveys at over 160 works, consuming about 12% of all the fuel used in the industry, and a study of all these reports shows that 19·4% of the fuel usage could be saved, and in addition other financial savings could be obtained as a result of a reduction in labour force, higher productivity and improved quality of product.

The reader may wonder why such opportunities for savings have been neglected by management, but part of the answer is probably that management is not indifferent, but insufficient. So many problems beset those in charge, particularly in view of the relatively rapid changes in demand and type of products since the war, that in many concerns there is just not enough management time or experience to go round. Consequently the available time tends to be concentrated on sales and production, at the expense of the services.

Also, a further part of the answer is that a considerable amount of fuel using plant was installed in pre-war years when coal was both cheap and abundant. The efficiency of the plant chosen at that time may well reflect the economics of a vanished era, and yet capital available since the war may have been deflected away from possible fuel plant improvements and used first of all for better premises, developing new processes or increasing production capacity.

The generation and distribution of steam is the direct responsibility of the works engineer, but although he may also be responsible for the installation and maintenance of process plant there are very few works indeed where he has any control at all over the use of steam in process. This is usually entirely in the hands of the production staff, who often object to any queries from the engineer as to why they use so much steam for a certain process. In some instances process staff decide when an item of plant shall be available for maintenance, and this usually leads to breakdown maintenance rather than preventive maintenance. As a result this interferes with quantity and quality of product, and at the same time increases the cost of steam per unit of product.

If £1,000 worth of the firm's products were spilt on the floor, or spoilt in processing, management would soon be enquiring into the causes, but £1,000 worth of fuel can be wasted in the boilerhouse or in steam utilisation and escape detection quite easily. It is the responsibility of management to see that there is the closest possible liaison between engineering and production staff to ensure each appreciates the other's problems and that both co-operate to produce the maximum quantity of high-grade product at minimum cost.

* Area Engineer, National Industrial Fuel Efficiency Service.

Improving boiler plant

Most firms have boiler plants for process or space heating. However it must be stressed that N.I.F.E.S.' experience is that equal or greater improvements can be made in the utilisation of steam or heat outside the boilerhouse.

Several thousand individual tests have been carried out by us on boilers of all types, and it is interesting to consider what these tests show.

Possibly the simplest steam boiler is the cross-tube vertical type, which can only be expected to have a moderate efficiency in any event. A target efficiency can be taken as 60%, but the average efficiency of those tested on solid fuel was 49% and about 10% of the sample succeeded in maintaining efficiencies below 40%. This simple type of boiler, used to meet small demands for steam, is often not adequately supervised and is likely to give smoke trouble, causing an offence under the Clean Air Act. There are better designs of vertical boilers available, and the average efficiency on solid fuel of these was 59%, which although a considerable improvement, is still not good. The target shown possible for this class was 72%. Even with oil firing, the average efficiency of this class was just over 62%, virtually no better than with solid fuel, so it cannot be claimed that the use of oil will give a large rise in efficiency regardless of the attention and skill of the operator.

Lancashire boilers are often found in the larger firms to meet steam demands, and although a target efficiency for these (fitted with feed water economisers) is 75%, the average efficiency of those tested was 65% using coal, or 73% using oil. While in most causes poor efficiencies were due to poor operation or unsuitable equipment, some boilers were far too large for present loads. They were probably installed many years ago when the firm had a steam engine, now replaced by electric drives.

In such cases it is very difficult to obtain high efficiencies and a case can usually be made, on financial grounds, for replacement by a smaller boiler better suited to the load.

A rather more modern boiler is the Economic type, of which several versions are on the market. The better designs should have a target efficiency of 78%, but the average efficiencies of those tested on coal was only 69%.

There is often a reluctance to spend money on boiler plant to bring it up to date. However, if any one inherited a house that was about 30 years old, his wife would insist on having modern equipment, such as a labour-saving kitchen, an efficient hot water system and a new bathroom. Similarly a boiler may need labour-saving equipment, such as automatic controls, mechanical stokers or oil burners and fuel handling equipment, or an efficient hot water system to collect all clean hot water for re-use (such as condensed steam from process and heating).

In almost every case, improvements to boilers, or to process plant, will recover their capital cost very quickly. Some cases are known where capital is recovered in less than a year, and two to three years is a common recovery period. This seems a very good investment, far better than most Stock Exchange transactions, yet in some cases it is very difficult to persuade the firms to invest.

Work on boilers is only a small part of the field of fuel efficiency, of course, but it is often tackled first in view of the common usage in almost every firm.

The results obtained from N.I.F.E.S. boiler-plant surveys clearly demonstrate two facts. First, that the average level of boiler operation in this country is far lower than it should be, and second, that new plant will not necessarily improve efficiency unless the operator is properly trained in its use and the plant is well maintained. The answer to these problems appears to be better training and better supervision, that is, better training of boiler operators and better supervision of operatives and maintenance by those responsible for boiler plants. It cannot be over-emphasised that new and improved plant will not of itself save fuel unless it is operated and maintained by competent staff who know what they are doing.

Fuel Saving Facts

★ *A thousand pounds' worth of fuel can be wasted quite easily without detection.*

★ *Oil firing won't increase efficiency without skilled supervision.*

★ *The cost of training good operators is negligible compared with the savings made.*

★ *Some boilers are far too large for present needs.*

★ *Instruments save nothing—savings come from the action taken on the information instruments provide.*

Boilers, whether fired by oil or coal, should not be operated by untrained personnel. Oil firing may not require so much skill as coal firing, nevertheless, an untrained operative can waste considerable quantities of oil, and oil means money. The cost of training boiler operators to an accepted standard, the City and Guilds Boiler Operators Certificate, is negligible compared with the savings that can be achieved.

Whether a boiler plant is fired with solid or liquid fuel, there is no point in producing or importing this fuel simply to meet a demand created by wasteful practices.

The services offered to industry by N.I.F.E.S. include heat and power surveys, which determine by accurate measurement exactly what losses of heat are occurring and where improvements in production methods can be made. Regular service agreements are used to provide continuing assistance, often to carry out the improvements indicated by a survey, although some large firms are using N.I.F.E.S. teams on an agreement basis to supplement their own technical staff. Where specialised advice on a single problem is required, a specific advisory service is available, so that the combined experience of all N.I.F.E.S. staff can be brought to bear.

The Clean Air Act has indirectly improved efficiency, by compelling firms to take a careful look at their fuel using plant, and N.I.F.E.S. have been successful in eliminating smoke nuisances at many firms. Grit emission has also been studied in many cases, and methods of reducing these emissions suggested.

Common boiler defects

The defects most commonly found on boiler plants are:

leaking blow-down, safety and feed check valves;
cracks in brickwork and seating blocks;
warped and badly fitting fire-doors and dampers;

defective insulation of boiler and pipework;
leaking joints;
burnt and badly fitting firebars;
worn and badly aligned stoker parts;
dirt and scale on heat transfer surfaces.

Lack of attention to these items is responsible for wasting a great deal of fuel, yet they cannot be considered under the heading of fuel efficiency; the correct classification is defective maintenance. An appreciable amount of fuel is used, and wasted, in banking fuel at night and during the weekend. Provided that maintenance is of a high standard—insulation, brickwork and dampers all in good condition—fires can be withdrawn at the end of the day and re-lit the following morning with little loss of boiler pressure. This practice can save a considerable amount of fuel.

Instruments

Instruments in many installations are conspicuous by their absence, in others by being out of service. A minimum standard of instrumentation is essential on every plant. Not only must the operator have sufficient instruments to guide him in the manner in which he ought to operate the plant, but he must also be taught to understand their function and how to interpret the information which they provide. It must be clearly understood that instruments as such will save nothing, the saving comes from action taken on the information which instruments provide. The instruments installed must be given regular attention to ensure that they function satisfactorily. If the works concerned has no staff trained in instrument maintenance then they should have selected staff trained by the manufacturer, or arrange a maintenance service contract with the instrument manufacturer.

£.s.d. of Fuel Saving in the Chemical Industry

★ *In a process department over half of the supply of 4,500 lb. of steam per hour heated old vessels no longer in use.*

★ *Proper insulation of seven autoclaves saved 22 tons of fuel a year.*

★ *Fitting a good lid to an outdoor tank saved 38 tons of coal a year.*

★ *Poor insulation and steam leaks cost one works 215 tons of fuel a year—13% of consumption.*

★ *A heat exchanger fitted to an evaporator saved £200 a year.*

★ *A £100 thermo-compressor saved £200 a year.*

★ *New nozzles on steam ejectors saved £575 a year.*

★ *Re-use of cooling water saved £950 a year.*

★ *Pharmaceutical firms can save a great deal of fuel by improving space heating on packing floors.*

★ *Improvement of electric power factor saved £900 a year for an equipment cost of £700.*

★ *The average capital cost of fuel saving plant is less than £10 per ton of coal saved per year, giving a gross return within two years. This investment is better than most Stock Exchange transactions.*

Process heat distribution

It is difficult to give a general picture due to the very wide range of equipment used in the industry, but a two-stage attack can be made. First of all, the steam distribution system should be examined for maintenance problems, such as missing or inefficient insulation and leaks and traps not functioning correctly. Losses due to poor insulation and steam leaks at one works were found to be equivalent to 215 tons of fuel each year, 13% of total consumption. Next every pipe should be considered in relation to its present duty, as often the process plant may have been repositioned or even completely replaced since the steam mains were first installed. Often large pipes exist but serve small items of plant, and this means an excessive radiation loss, even from an insulated pipe, and in turn this may give unduly wet steam to the process, causing waterhammer, slow heating, and possibly overloading of the traps. Perhaps smaller mains could be fitted. Where processes are intermittent, it is almost certain that all steam spaces in the plant will fill with air when cold, and often little attention is given to fitting automatic air vents or in choosing the right steam trap that will vent air rapidly in starting up the process. This again gives rise to complaints of slow heating.

Again, due to changes in the layout of plant, there may be lengths of steam main with no users being served by them. If they cannot be dismantled because of a possible future need, care should be taken to see they are not left full of steam. If possible a blanking-off plate should be fitted at an inlet flange rather than relying on an isolating valve which may leak or be opened accidentally. In one process department meters were fitted and proved that 4,500 lb. of steam per hour was used to heat storage tanks and supply line tracing. It was found that over half was passing to heating coils in old vessels that were no longer in use.

After successfully distributing the heat with the minimum of loss, the return side should be checked. Where steam is used, all available pure condensate should be collected as hot as possible and returned to the boilers for feed purposes, both to reduce scale formation and also the fuel usage. Sometimes distances may be great and pure condensate quantities small, so that the cost of return is high, but hot condensate can also be used for process work in many cases; one successful use is as hot pure feed to a distilled water plant, or as washing water. Where steam is used at high pressure there is also a good case for a flash vessel in which condensate pressure can be reduced and a proportion converted to low-pressure steam.

Savings on individual processes

The first stage has been discussed so far—tightening up the distribution—but usually major savings are also possible by examining individual processes. This involves first of all a "balance," or comparison of the heat supplied to the theoretical requirements. After this a

study should be made of the heat wasted from the process, in vapour, cooling water or hot products, and the real savings are often made if this waste heat can be re-used in other processes, or for space heating. In view of the very wide variety of plant, examples only can be given to illustrate what may be done.

Jacketed lines

In one very large works it was found that 2,500 lb. of steam per hr. was used solely to heat the jacketed product lines. This represented about 30% of total process usage, but 25% was saved by improving insulation, eliminating long uninsulated runs between the user units and their steam traps and elimination of by-pass leakages. Further work showed that if the steam and pipe connections could be rearranged so that the lines were only heated immediately prior to and during passage of liquids even greater savings could be made.

At another firm, seven autoclaves were used daily for sterilising purposes, and proper insulation saved 22 tons of fuel each year.

Pans and tanks

Boiling pans and liquor-heating tanks are another source of waste. At one firm, water in the jacket of a crystallising pan was heated by injecting steam. The water was frequently blown to drain, when steam blew straight to waste until the jacket was re-filled. A thermostat control saved 2s. for each hour this wastage had previously occurred. In another case an outdoor tank in a hydration process was kept at a constant temperature by steam injection. The fitting of a proper lid saved 38 tons of coal each year. At another works belonging to this same firm, fitting a lid to a caustic vessel saved just over 8 tons of coal a year.

Evaporators and stills

Evaporators and stills with their attendant condensers often give scope for heat recovery. On one multiple-effect evaporator the weak inlet liquor was cold, and condensed steam from the calandrias was run to drain partly due to fear of contamination and partly due to the distance from the boilers. A heat exchanger was fitted and the condensate used to preheat the inlet liquor, saving £200 per year. Another evaporator, a single-effect one, was found to be using over 1½ lb. of steam to evaporate 1 lb. of water. A thermo-compressor unit was fitted which recirculated some of the vapour to the heating coils, and this halved the steam consumption, saving £200 each year for an expenditure of £100.

Reflux ratios in stills are often determined arbitrarily and then never altered. At several firms tests have showed lower ratios could be used without any effect on products, giving reduced steam and cooling water usage, and often increasing throughput.

Steam ejectors

Steam ejectors are often used as a cheap and convenient method of providing vacuum, but frequent checks should be made on their nozzles for wear and alignment. Replacement of worn nozzles on one plant reduced steam consumption from 490 to 220 lb./hr. saving £575 in fuel a year.

Cooling water re-use

Cooling water is often run to waste from condensers, but at one firm it was measured and found to be 3,200 lb./hr. at 188°F. Its collection and use as process hot water saved £950 a year. Often cooling water is wasted because it only rises a few degrees in temperature passing through a condenser. However experiments may show its quantity can be reduced very considerably to give a useful exit temperature without affecting production.

Where vapours are not passed to a condenser, scope exists for heating water. At one firm the contaminated vapour passed through a scrubber to remove corrosive chemicals, but tests showed the residual heat content was still large, and a spray condenser was built to recover the heat. The hot spray water, which was contaminated with carried-over chemicals, was circulated through a plate-type heat exchanger to give pure hot water for process. Many firms have quite large bottle washing units, and the dirty hot water overflowing from these can often also be passed through a heat exchanger to give clean hot feed to the machine and so reduce the steam usage.

Dryers

Many products have to be dried, and for small batches the tray or cupboard type dryer is often used where warm air is circulated over the material. A few common faults can be mentioned, some of which also apply to other types of dryer.

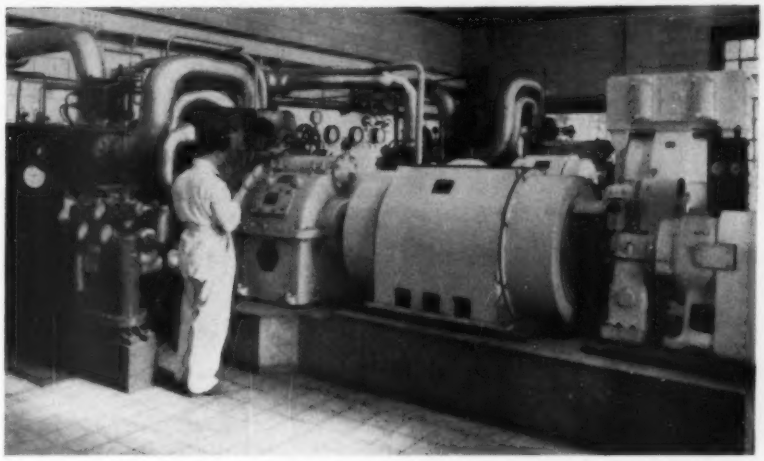
In many cases it was found air entered through joints and gaps between doors, walls and floor, in some instances so much air infiltrated that the volume of exhaust air leaving the dryer was virtually constant for all positions of the inlet damper. Also many inlet and exit dampers do not seal properly, so control is not precise; in one case with all dampers "shut" the air flow through a dryer was still 25% of the "full-open" quantity.

If uneven air velocities or temperatures exist over different trays, or over different parts of the same tray, some portions of the material will dry more slowly and drying times may be extended in order to ensure all areas are adequately dried. New baffles or redesigned air ducts may give more uniform conditions. The drying rate is usually constant at first and then falls off until the last traces of moisture take a considerable time to remove, so a single damper setting cannot give optimum efficiency, and the air change should be reduced during the cycle.

Space heating

Many firms, particularly pharmaceutical manufacturers, have to break down their products into small doses or packages, so that a large proportion of their floor space may be devoted to packing, stock and dispatch areas; as labour for this work may well be mainly female a good standard of heating is required. Obvious points are good insulation of the buildings, particularly the roof, thermostatic control of the heating system, preferably in sections, and air-locking of dispatch doors to try to prevent uncontrolled cold draughts.

However, perhaps slightly less obvious are other points, commonly found as faults in factory heating. Ventilation is of course necessary and important, but in packing, etc., where obnoxious smells or dusts do not usually occur it is often excessive. The minimum fresh air requirements are usually taken as about 750 cu. ft./hr./person, and this is usually much less than the natural air change due to cracks and winds, so that in winter it should usually not be necessary to use fans to ventilate such an area, and much greater attention should be given to



Steam generation is of importance in power production as well as heating for various processes. For plant operation and general services such as lighting, etc., optimum functioning of all power producing plant is imperative. Here two engineers discuss steam generator performance in the turbine house of a chemical works.

reducing draughts through badly fitting doors and windows or between sheet panels.

Next, vertical temperature gradients are often high. To maintain 65°F. as a comfort temperature near the floor, a poor system may give rise to very high temperatures, up to 85°F., just under the roof, so giving excessive structural heat losses. The traditional method of overhead steam piping is particularly at fault, and fitting of reflectors, or replacement by overhead steam radiant strip heating can give equal comfort at working level for a reduced fuel consumption.

In loading bays and dispatch areas, it may be impossible to give full comfort heating over all the floor space, but spot-heating is desirable. The installation of vertical discharge unit heaters just inside loading doors can prevent penetration of cold draughts, if their motors are linked to the doors so that they operate whenever the doors are open. Radiant-panel heaters are also useful, and in very open areas, high-temperature ones, such as gas or electric units, are best as the radiation is more intense and can be directed into a small area. For less exposed spots steam-heated radiant panels or radiant strips can also give good spot-heating.

Conclusion

Other items could be mentioned, such as improvement of electricity power factor, and checking of lighting intensities and efficiencies. For example, a detailed check of the use of electricity at one firm showed that by improving the power factor an annual saving of £900 could be obtained for an equipment cost of £700. However, it is hoped sufficient has been said to show the wide scope for improving efficiency and reducing production costs.

An analysis of hundreds of surveys has shown the average capital cost, where new plant has to be recommended, was under £10 per annual ton of coal saved, or a return in gross savings within two years. Consequently, to those who have not already taken action, the recommendation is made to do so at once, as a good investment now will prove even better as time passes.

Industry's Publications

Water conservation. A bibliography of references in published literature on water conservation and allied fields has been produced by Price's (Bromborough) Ltd. It covers reservoir evaporation, the theory of evaporation, surface chemistry in general, hydrology and meteorology.

Chromatography. Materials for chromatography supplied by B.D.H. are listed in a new leaflet.

Evaporators and crystallisers. Kestner Evaporator and Engineering Co. have issued a brochure describing their climbing film evaporator and ancillary plant such as heat exchangers, coolers, condensers and vacuum raising equipment. Tables give hydrometer scales and properties of saturated steam. Another new brochure deals with their high vacuum crystallisers. Liquor to be cooled is subjected to a high vacuum in one or more stages and so is given a flash evaporation.

Index of new chemicals. Index Chemicus, a monthly index to more than 60,000 new chemicals reported each year in the scientific literature, is now available from the Institute for Scientific Information, Philadelphia, U.S.A.

The inaugural issue reports over 3,700 newly synthesised compounds. It contains listings of chemical names, structural diagrams, and molecular formulæ as well as complete bibliographical information including article title, authors, institutions, addresses, and original journal references and page locations for each compound. In addition, indexes are cumulated quarterly and yearly.

Aluminium. The new firm, Imperial Aluminium Co. Ltd., has published a brochure on the uses of its aluminium sheet and strip.

Radio - frequency heating. Technical Notes No. 213 from CIBA (A.R.L.) Ltd. describes and illustrates principles of radio-frequency heating.

Chlorinated solvents. A handsome publication in French from Solvay et Cie gives full information on these products.

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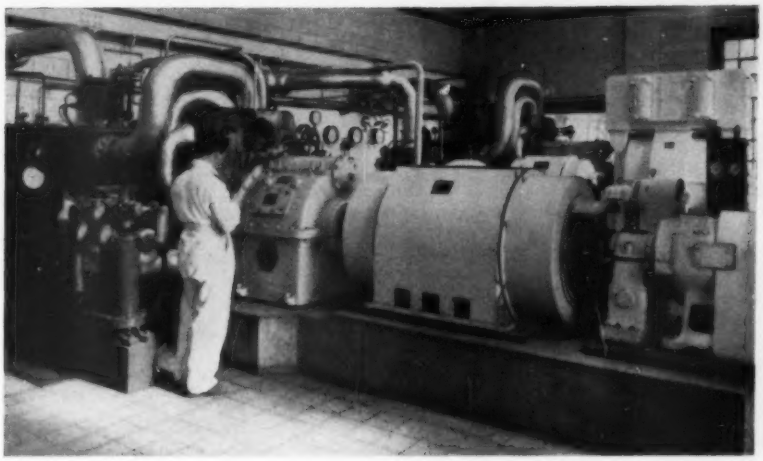

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reducing draughts through badly fitting doors and windows or between sheet panels.

Next, vertical temperature gradients are often high. To maintain 65°F. as a comfort temperature near the floor, a poor system may give rise to very high temperatures, up to 85°F., just under the roof, so giving excessive structural heat losses. The traditional method of overhead steam piping is particularly at fault, and fitting of reflectors, or replacement by overhead steam radiant strip heating can give equal comfort at working level for a reduced fuel consumption.

In loading bays and dispatch areas, it may be impossible to give full comfort heating over all the floor space, but spot-heating is desirable. The installation of vertical discharge unit heaters just inside loading doors can prevent penetration of cold draughts, if their motors are linked to the doors so that they operate whenever the doors are open. Radiant-panel heaters are also useful, and in very open areas, high-temperature ones, such as gas or electric units, are best as the radiation is more intense and can be directed into a small area. For less exposed spots steam-heated radiant panels or radiant strips can also give good spot-heating.

Conclusion

Other items could be mentioned, such as improvement of electricity power factor, and checking of lighting intensities and efficiencies. For example, a detailed check of the use of electricity at one firm showed that by improving the power factor an annual saving of £900 could be obtained for an equipment cost of £700. However, it is hoped sufficient has been said to show the wide scope for improving efficiency and reducing production costs.

An analysis of hundreds of surveys has shown the average capital cost, where new plant has to be recommended, was under £10 per annual ton of coal saved, or a return in gross savings within two years. Consequently, to those who have not already taken action, the recommendation is made to do so at once, as a good investment now will prove even better as time passes.

Industry's Publications

Water conservation. A bibliography of references in published literature on water conservation and allied fields has been produced by Price's (Bromborough) Ltd. It covers reservoir evaporation, the theory of evaporation, surface chemistry in general, hydrology and meteorology.

Chromatography. Materials for chromatography supplied by B.D.H. are listed in a new leaflet.

Evaporators and crystallisers. Kestner Evaporator and Engineering Co. have issued a brochure describing their climbing film evaporator and ancillary plant such as heat exchangers, coolers, condensers and vacuum raising equipment. Tables give hydrometer scales and properties of saturated steam. Another new brochure deals with their high vacuum crystallisers. Liquor to be cooled is subjected to a high vacuum in one or more stages and so is given a flash evaporation.

Index of new chemicals. Index Chemicus, a monthly index to more than 60,000 new chemicals reported each year in the scientific literature, is now available from the Institute for Scientific Information, Philadelphia, U.S.A.

The inaugural issue reports over 3,700 newly synthesised compounds. It contains listings of chemical names, structural diagrams, and molecular formulæ as well as complete bibliographical information including article title, authors, institutions, addresses, and original journal references and page locations for each compound. In addition, indexes are cumulated quarterly and yearly.

Aluminium. The new firm, Imperial Aluminium Co. Ltd., has published a brochure on the uses of its aluminium sheet and strip.

Radio - frequency heating. Technical Notes No. 213 from CIBA (A.R.L.) Ltd. describes and illustrates principles of radio-frequency heating.

Chlorinated solvents. A handsome publication in French from Solvay et Cie gives full information on these products.

THE SCENT OF FLOWERS AND LEAVES *A Search for Fragrance among the Minor Natural Orders*

By Edward S. Maurer, F.L.S., M.R.I.

3. The Primrose and Cyclamen Family *(Primulaceæ)*

The delicate scents of many species of primulas combined with the perfume of the allied cyclamen nuance offer opportunities for intriguing bouquets of special value for face lotions. Mr. Maurer's two previous articles covered bindweeds (January) and arum lilies (February).

THERE is nothing of the "rose" in any member of the primrose family except the name. This is said to be a corruption of the old French *primerole* which, like the Latin *primula*, means the first of the early spring flowers. The *primulas* are annual or perennial herbaceous plants, natives chiefly of the cold and temperate regions of the Northern Hemisphere. Numerically it is a small order, there being about 30 genera and some 450 species among which, however, are several outstanding examples of complex rustic fragrance of interest to the perfumer. Although there are a few instances of medicinal plants valued for their glucosides, I find neither objectionable propensities nor malodours. However, some people are allergic to a skin irritation as a result of handling certain conservatory species of the *Auriculas*.

Poetic eulogies

The primrose is a flower of the poets and pages of apt allusions from the works of Shakespeare, Milton, Keats, Herrick, Shenstone, Spenser and many others grace the floral anthologies.

The primrose was known in mythological times as paralisos, after the name of the son of the goddess Flora who pined away from grief for the loss of his betrothed Melicerta, but we are told that he was metamorphosed into "the rathe (early) primrose that forsaken dies" (Lycidas).

The botanical texts divide this family into four main groups, the common names of which are a rough indication of the type, namely, (1) Primroses and Cowslips, (2) *Anagallis*—Pimpernels, (3) *Samolus*—Water pimpernels, and (4) *Hottonia*—Water Violets.

All these are represented by wild prototypes, but as is early evinced in this study, the major part of the family comprises scores of hybrids to be found among the polychromatic polyanthes and auriculas—the mere cataloguing of which occupies many columns in the garden manuals and florists' lists, and demands considerable scrutiny before any data emerge regarding the source of, and type of, scent to be found.

Fragrance types

In this small order there is no extensive panorama of fragrance, although what there is is of considerable potential interest to the perfumer. The three main types are the primroses and cowslips, the American primroses and the cyclamens. These scents are not floral primary odours like rose and jasmin but are composites or natural bouquets, which in my opinion may be basically regarded as a liaison between the fragrance of the violet and the madonna lily.

The name of an Asiatic species, viz. *Primula anisodora*, hints at the scent, for supporting the basic nuance there is a soft, sweet anisic undertone which, incidentally, may also be observed upon examining the roots of some of the common garden species.

Flowers of the springtime

Roy Genders in his "Perfume in the Garden" (1955) remarks that "after the long winter days, the first flowers of springtime are awaited . . . the primrose, the violet and the auricula, whose delicate perfume reminds one of the woodland glades where they are happiest. A bunch of primroses gathered whilst the showers of April are still falling smells of moss, bracken and dead leaves, more than it does of any particular flower. Only a few primrose varieties possess a distinct fragrance of the woodlands. It is an invigorating perfume. . . .

"Of the hundred varieties grown for nearly a century, a Tudor primrose, still known as Quaker's Bonnet, has flowers of a delicate pure lavender colour and the true wild primrose perfume. Possibly the most vigorous grower is Marie Crousse, which covers itself with rich purple flowers and possesses easily the strongest perfume of all the primroses, being almost as powerful as the old red cabbage roses.

"Its perfume may be more accurately described as being like that of Rose Tahiti—'sweet and delicious'."

This author also remarks of the ordinary Juliæ hybrids that he finds the lovely variety Craddock's White possesses the most distinct fragrance, almost like ripe apples, while of the garden auriculas the pale yellow blooms of Celtic King carry a powerful lemon perfume; the purple-blue variety Blue Velvet is strongly fragrant with the scent of honeysuckle; Faldonside bears rich velvety-crimson blooms—all these remain long in bloom and "distil their perfume over a wide area."

Towards the end of the chapter the author remarks that "those who have a stream running through

their garden (bearing in mind the aquatic habit of sundry members of this family), or who are blessed with a pond or moist shady corner, will find that several of the Asiatic primulas give out a delightful delicate fragrance by night as well as by day . . . several carry no distinct perfume, others do, and none is sweeter than *P. Sikkimensis*."

Miss E. S. Rohde in her "Scented Garden" suggests that the "best of all . . . is *P. Florindæ*, the giant of the Sikkimensis primulas, and although only discovered in 1924 by Captain Kingdon-Ward, this glorious cowslip-scented primula, producing its bright yellow trusses of flowers in August, is already known to almost every garden lover." Incidentally, this explorer in the 1952 edition of his "Plant Hunter in Manipur" gives a detailed account of his discovery.

The elementary primulas

These may be positioned as follows:

Primula vulgaris var. *aculis* is the common primrose; *P. veris*, the common cowslip or herb peter; *P. eleatior*, the common polyanthus or oxlip; while *P. auricula* is the French mountain or alpine cowslip, auricula, bear's-ears or dusty miller. But we should particularly note that *P. variabilis*, the common culverkeys, is a prototype, intermediate in character, as some forms approach the cowslip and others the stalked variety of the primrose, or, expressing it in another way, some forms of *P. polyantha*, *P. veris* and *P. Sinensis* initiate the many multi-coloured cultivated hybrids of the garden.

The fragrant primulas

The "Fragrant Garden" books devote an appendix to various groupings of similar scented blossoms, but about the primulas, beyond a generalisation of "delicately perfumed" or "sweetly scented," no precise details are forthcoming.

Simulating the primula scent

I gathered sufficient material to fill a medium-sized desiccator, replaced the lid and left it for an hour or so in a sunny place. When moisture appears inside the lid, this is the time to remove it and literally bury one's nose among the blooms.

My first impression of the concentrated primrose bouquet under these conditions suggests a liaison between the scents of a tea rose and an amaryllis lily, but there is also a distinct violet-leaf undertone and finally a slight shading as from a Niobe-wintergreen complex — a nuance which I find common in the blossoms of a number of hothouse plants. (Note: this adjunct is based upon 0·1% each of methyl benzoate and methyl salicylate in linalol.)

On these lines I have produced simulations which very closely approach the *in vivo* fragrance of the primrose when examined in accordance with the above procedure.

Aromatic components

The essential oil texts deal at considerable length with the chemistry of the enzyme Primeverase, and in addition there is the important work of Gorris and associates, as reported in the *P. & E.O.R.* for October 1946, June 1949 and November 1950. From the roots of a number of species the following aromatic materials have been isolated, namely the methyl esters of 2-hydroxy-4 (or 5)-benzoic acids and also 2-hydroxy-4 (or 5)-methoxy-acetophenone, as well as the methyl esters of β-methoxy-resorcylic and salicylic acids. The essential oil from the flowers is practically identical with that distilled from the roots.

Cowslip and oxlip fragrances

By adopting the same technique for examination, I find the fragrance of cowslips is much stronger and more floral when compared with the more delicate nuance of the primroses and has a somewhat violet blossom backnote, whereas the oxlips suggest a lily-lilac fragrance. Two glucosides are present in appreciable quantities, which may account for the rapidity with which, after only a few days' fermentation, the characteristic bouquet of cowslip wines is developed which, after a few months' maturing, results in a pleasant, apparently innocent but nevertheless potent drink.

Cyclamen

"The sweetly-scented *Cyclamen Europæum* blooms in the sun and shade through late summer into autumn, its dainty blooms hovering above the marbled foliage like dozens of crimson butterflies" (Roy Genders in "Perfume in the Garden"). The generic name comes from the Greek *kyklos*, meaning a circle, alluding to the coiled stems of the seed vessel. Species common to the Levant are known collectively as "apples of the earth," dillnotes or mitre-flowers, but *C. Europæum* in the earlier garden manuals is listed as "bleeding nun," "sow-bread" or "ground-bread," for the plants are found growing wild in some sub-alpine districts, the fleshy root-stock providing food for animals.

The garden manuals list upwards of a score of light and dark crimson, purple and white-flowered varieties, and among these *C. odorum* and *C. Persicum* are noteworthy for their strong fragrance. In my opinion everything that could be usefully collated appears in the monograph by H. M. Dumont which appeared in *Soap, Perfumery and Cosmetics* for October 1936, and also in the account given in W. A. Poucher's Volume II.

The cyclamen does not yield a marketable essential oil or a popular handkerchief perfume and its name does not appear often on such commodities as soap, bath salts or talcum powders, but in the perfumer's palette it takes its place with his interpretations of exotic greenhouse and tropical blossoms such as freesia, frangipanni, camellia, stephanotis and gardenia.

I think it remarkable that among the many bulbs and rhizomes we find in the blossoms only three distinctive types of fragrance, namely the lily among the lilies and amaryllis, hyacinth in the hyacinths and narcissi, and violet among the iris and ixias. If we revert to the fragrance pattern for the cowslips and oxlips we can observe that, transposed into another key, we have at once the characteristic scent of the Persian cyclamen. Here I find the basic note to be a violet complex based upon the methyl ionones and backed by muguet, and it is therefore understandable why the term "Alpine Violet" has been used to describe the colour as well as the scent of the blossoms of this species.

In perfumery there are several instances where some of the modern synthetics have a basic note which is of great value in the simulations of semi-exotic floral bases, for example, phenylmethyl carbinyl esters in gardenia and methyl acetophenones in mimosa. In the build-up of the cyclamen nuance it is interesting to observe that starting with cuminic aldehyde, this is processed to finally yield iso-propyl *alpha*—methyl hydrocinnamic aldehyde which markedly resembles the basic cyclamen scent, and when floriated by rose, jasmin and neroli affords a close imitation of

the fragrance of the Persian species. Some "Notes from Fellows" appeared in the November 1958 and January 1959 issues of the R.H.S. Journal, from which it would appear that some species of *C. Neapolitanum* are delicately scented when the blossoms first open, but are odourless after 24 hr.

The American cowslip

The genus *Dodecatheon* (the 12 Gods) is commonly known as the "Shooting Star," for this is aptly descriptive of the graceful pendant pink flowers which remind one of fireworks. The garden handbooks remark that these plants are extremely attractive for the bog garden, the flowers being somewhat similar to small cyclamens carried on stiffly erect stems 12 to 18 in. high and having an "oddly sweet scent."

The most commonly grown species in British gardens is *D. Meadia*, with rosy-purple or white flowers. It thrives best beside a pool or a slow stream, but the fragrance is very different from that already noted, being of a strong, spicy, cinnamon type. In some varieties this redolence appears to veer more towards a spicy carnation or sweet william fragrance.

Among the half-dozen indigenous American species of these "Indian Prairie Flowers," a similar composite fragrance is reported for *D. Jeffreyanum* and *D. Clevelandi*, the giant American cowslips. One of the very few malodorants in this family is *D. Hendersoni*, which has the fæcal odour of an open tan pit.

Further aquatic primulas

The aquatic proclivity of this order, particularly among the wild plants, is evinced by the following examples, most of which must be sought for assiduously among the lush water-meadows and woodland streams of southern England.

Hottonia palustris: This is the water violet, water feather-foil or water gilly-flower, the pale pink blossoms of which *en masse* have a delicate nuance suggestive of violet and wallflowers.

Anagallis: This word in Greek signifies a laugh, for according to Pliny, when taken internally, it removed melancholy. *A. arvensis* is the familiar (but scentless) "poor man's weatherglass," "shepherd's clock," or "scarlet pimpernel."

Lysimachia: L. nummularia—this yellow buttercup-like flower is perhaps the most familiar of the wayside wild flowers. It has many country names, for instance "creeping-jenny," "herb-twopence" or "money-wort loose-strife." Its leaves are dotted with tiny oil cells and a handful rubbed between the palms liberates a long-lasting sweet resinous-herbal odour. *L. nemorum* is the yellow pimpernel or wood loose-strife, while *L. vulgaris* is the great yellow loose-strife.

Centunculus: C. minimus is the N. American false pimpernel; *Samolus valerandi*, the N. European brook-weed or white water-pimpernel; *S. littoralis* is the Tasmanian water-pimpernel or wild water-thyme—all possess foliage which is slightly aromatic on bruising.

Androsace: There are upwards of 40 of these alpines, of which *A. chamæjasme* is the pink-flowered Australian false jasmin; this and *A. villosa* are probably the best known from their sweet jasmin-toned primula fragrance.

Summary

Primulas do not have any particularly outstanding fragrances, but the delicate scents of the various species provide homely rural bouquets. Following the suggestions given for the simulation of the odours of the allied cowslips, oxlips and prairie flowers, these, when linked with the cyclamen nuance, may offer the perfumer opportunities for intriguing bouquets particularly suitable for face lotions.

Acetic acid. Bulk handling and storage of acetic acid increases process efficiency and saves manpower. These advantages should be set against the initial installation costs, advises a new booklet from the Distillers Co. It also enables buyers to profit from the tanker allowance given for bulk supplies. The basic facts necessary for providing bulk handling and storage installations are given in this useful book.

BP Research. The chemicals division is the newest section of the British Petroleum Co.'s research centre at Sunbury, Middlesex. Considerable recruitment of staff to work on petroleum chemicals will take place in the next five years and a new laboratory will be built to house them. This is stated in a new booklet, "Research at Sunbury," which describes—with colour photographs—the work at this important centre.

MANAGEMENT EFFICIENCY IN THE PHARMACEUTICAL INDUSTRY

(*Continued from page* 110)

typical example of the impact on management of a top management comparison.

There are, of course, other ways in which an IFC can help management. Where firms make similar products or use similar processes, IFC of costs and productivity can provide information which is sufficiently detailed to help those responsible for departmental activities in detecting specific operational weaknesses.

5. What IFC can achieve

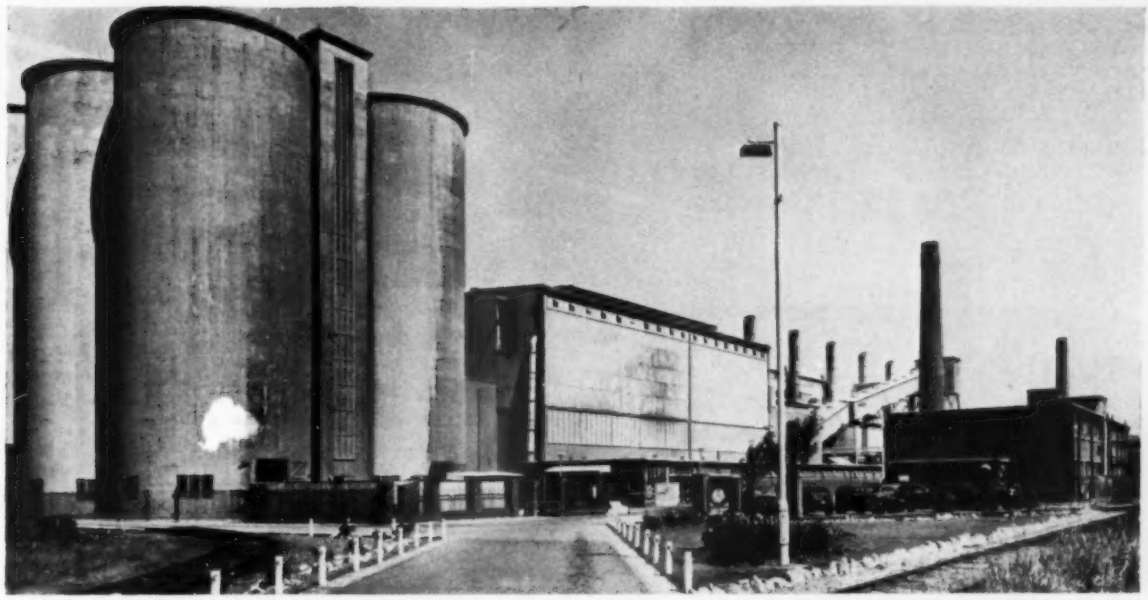
The individual firm benefits from an IFC not only in the ways described so far, but also because IFC is likely to raise the level of efficiency in the industry concerned. This can have many beneficial results on individual firms; for instance, an industry may have lost its good reputation in its export markets because its less efficient firms have given inferior or delayed deliveries.

As a result of this, even the efficient firms of the industry may not be able to obtain orders. The general improvement brought about by an IFC may re-establish the reputation of the industry abroad.

Incidentally, this example shows how short-sighted those firms are which regard themselves as the most efficient ones in their industry and which therefore think that they have nothing to gain from taking part in an IFC.

6. IFC in the British Pharmaceutical industry

An IFC of the kind outlined above is at present being prepared for British pharmaceutical manufacturers. The Council of the Association of British Pharmaceutical Industry agreed that a meeting should be held at which the subject could be presented by the Director of the Centre for Interfirm Comparison and discussed in general terms. The meeting was held in June 1960, and subsequently a number of interested firms assisted the Centre in preparing a draft scheme which was circulated in outline to some of the members of the Association. Companies wishing to take part in this scheme should contact the Director, Centre for Interfirm Comparison, 80 Fetter Lane, London, E.C.4.



The entry to the factory at Portishead. On the left are the phosphate rock storage silos.

New Processes Meet Growing Demand for Phosphorus

There is a steadily growing demand for phosphorus from manufacturers of fertilisers, pesticides, plasticisers, oil additives and chemical intermediates. Match manufacturers, of course, still use large quantities, but whereas in 1914 they took 75% of production, today they take just 1%, although the quantity they use has remained constant. Over half of Britain's production of phosphorus comes from the Albright and Wilson plant at Portishead, near Bristol. Here is a description of this extremely modern plant.

PHOSPHORUS occupies a significant position in the chemical hierarchy. With an atomic number 15 it is situated between silicon 14 and sulphur 16 in Period 3 of the periodic table. Both silicon and to some extent sulphur have tended to form independent chemical disciplines compatible with that of carbon chemistry. This tendency has enabled chemists to elucidate the systematic chemical structures of the varied silicon and sulphur compounds. In recent years the existence of a number of homologous series in the chemistry of phosphorus has shown that some day phosphorus chemistry may be developed into as elegant a discipline as present-day organic chemistry. Unlike carbon, however, phosphorus is not quite as freely available and for this reason the economic manufacture of this product is of the utmost importance.

Organic sources

Although phosphate fertilisers have been used for over 2,000 years phosphorus was not isolated until 1669, when the alchemist Brand prepared it by evaporating urine and distilling the residue to yield sodium metaphosphate. On further heating with carbon this produced phosphorus. This method, though functional, could scarcely be adapted to mass production. A new plentiful source of raw material was revealed by the Swedish chemist Gahn in 1769, who showed that phosphorus is an essential constituent of bones.

The industrial revolution in England and the growing needs of the match industry created a large-scale demand for phosphorus. In 1844 Arthur Albright started the first commercial production, using bones and bone ash as raw material. After grinding, the bones were treated with sulphuric acid and the orthophosphoric acid formed was separated by filtration.

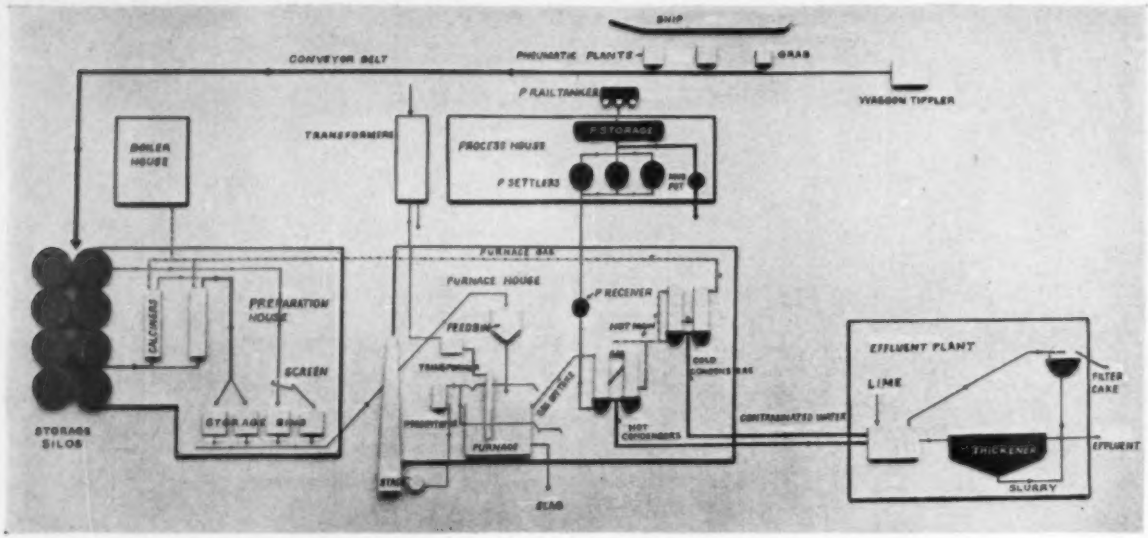
$$Ca_3(PO_4)_2 + 3H_2SO_4 \longrightarrow 3CaSO_4 + 2H_3PO_4$$

This acid was then evaporated to about one-quarter of its volume and mixed with charcoal and coke. The resulting mixture was heated in retorts to convert the orthophosphoric to metaphosphoric acid, which was then reduced by the carbon present

$$4HPO_3 + 12C \longrightarrow P_4 + 12CO + 2H_2$$

The phosphorus was distilled off, condensed under water and subsequently purified.

Nowadays the most important mineral source of phosphorus is fluorapatite, $3Ca_3(PO_4)_2 \cdot CaF_2$, known as phosphate rock. Common impurities in this mineral include calcium and magnesium carbonates,



Flow sheet for the electrothermal process of phosphorus manufacture.

ferric oxide and aluminium oxide. Phosphate rock is found in immense deposits in the United States, North Africa and the Middle East. World consumption was about 32 million tons in 1958.

Present-day manufacture

Albright and Wilson, the company which Arthur Albright founded, are the sole producers of phosphorus in Great Britain. Their main phosphorus plant at Portishead is located near the Bristol Channel. Yellow phosphorus produced there is distributed to other factories in the company to initiate processes that provide a wide range of products, such as insecticides, plasticisers, flotation reagents and oil additives.

Manufacture at Portishead is by the electrothermal process which was first patented in 1888. The three basic materials used are phosphate rock, silica chippings and anthracite. The reaction is carried out under heat in a furnace according to the following equation:

$$2Ca_3(PO_4)_2 + 6SiO_2 + 10C \longrightarrow CaSiO_3 + P_4 + 10CO$$

Storage

An important part of the factory is the unloading and storage facilities which ensure a continuous supply of new materials for the process. Ships carrying 6,000 tons of phosphate rock from Florida are unloaded by pneumatic suction plant and then passed by a conveyor belt to storage silos. Each of the eight storage silos contains 2,200 tons of phosphate rock, while stored between the silos are approximately 2,000 tons each of anthracite and silica chippings.

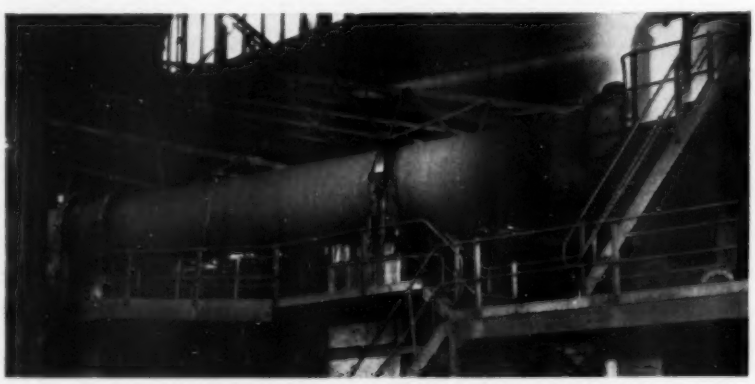
The silica and anthracite drawn from the storage silos are dried in the calciners and then go into intermediate storage. From there the various ingredients are batch weighed to give the correct chemical composition for feeding into the furnaces. Electrically controlled weighing machines are used to weigh batches of 4,500 lb. every 2½ min. and these are discharged simultaneously on to conveyor belts leading to storage bins above each furnace.

Furnaces

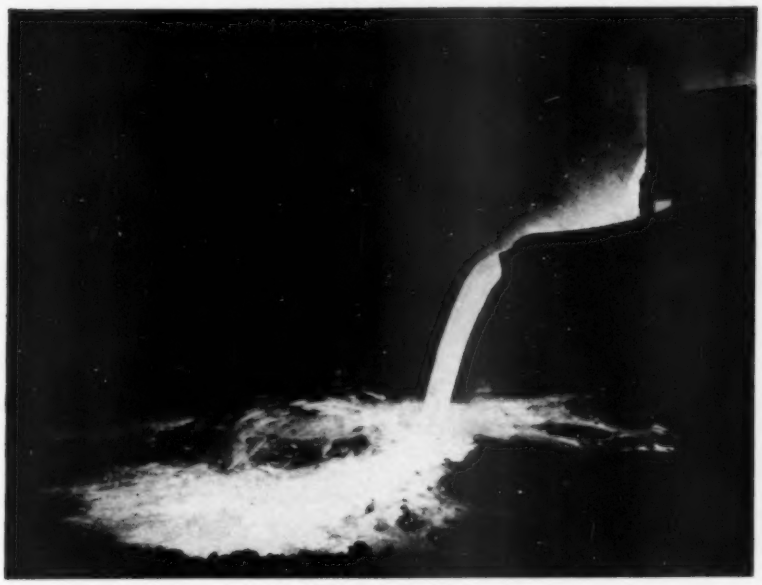
The raw materials are fed into six furnaces each 25 ft. in diameter and 11 ft. 7 in. high. These are made of firebrick, lined on the hearth and lower wall sections with carbon blocks. In each furnace there are six carbon electrodes 2 ft. in diameter, which are powered from transformers at 150-170V and 5,500-7,000A to raise the temperature to 1,300°C. The electrodes are suspended vertically on winches through the furnace roof so that their current can be maintained by vertical adjustment. New carbon sections are screwed into the top as soon as the old ones have burned away. Consumption of electric energy is about 6-7 kWh/lb. of phosphorus produced, and it should be noted that the electric current only provides the high temperature necessary for this endothermic reaction.

The products of the furnace are gas (chiefly carbon monoxide, hydrogen and phosphorus vapour), slag (calcium silicate) and ferrophosphorus.

Only 50% of the heat input into



One of the three calciners in the preparation house for drying the silica and anthracite.



Calcium silicate slag being removed from the furnace.

the furnaces is used in the reaction. The remainder can be accounted for as follows: 30% heat in slag, 5% in exit gases, 10% radiation losses and 5% transferred to cooling water. It would seem therefore that a more efficient heat utilisation could considerably reduce the electrical consumption.

Since the pressure of gas in the furnace is only just above atmospheric, it is only necessary to seal the gap between the electrodes and the furnace by means of a simple packing. This has the additional advantage of acting as a pressure vent to release sudden bursts of flames caused from time to time when the molten mass within the furnace collapses.

Condensation of phosphorus vapour

The gas is conducted from the furnaces to two hot condensation towers, set in series, where it is sprayed with hot water. This reduces the gas temperature to about 60-70°C. and the phosphorus vapour condenses out as a liquid which is contaminated with solids carried over in the gas stream. For two or three days the liquid is kept under water in settling tanks and during this time the contaminants rise to the top of the phosphorus. The phosphorus is then pumped into storage tanks, where it is kept under water until despatch by road or rail. The furnace gas is used in the boiler house for steam raising (ideally this should be adequate to produce all the steam, but variations in the calorific value of the gas have discouraged too much reliance on it as a fuel). The slag when tapped from the furnace is separated into calcium silicate, used for road surfacing, and ferrophosphorus, used in the manufacture of certain steels.

The product is transported mainly in rail tankers which are filled from underground storage tanks. These tankers can hold up to 48,000 lb. of phosphorus and are specially constructed to ensure maximum safety during the journey.

Uses

World production of phosphorus in 1958 was about 440,000 tons, of which the United Kingdom contributed 24,000 tons—the annual production at Portishead is just over 13,000 tons. About 90% of the phosphorus produced in this country is converted to orthophosphoric acid, of which 80% is used in the manufacture of various phosphates. This would indicate that the wet process, in which phosphate is decomposed by sulphuric acid to give orthophosphoric acid according to

$$Ca_3(PO_4)_2 + 3H_2SO_4 \longrightarrow 3CaSO_4 + 2H_3PO_4$$

is both cheaper and simpler by avoiding the conversion of phosphorus to orthophosphoric acid.

The next largest use of phosphorus is in the preparation of phosphorus chlorides, thiophosphoryl chloride, $PSCl_3$, and phosphorus pentasulphide, P_2S_5. A smaller proportion of the output is cast into sticks and wedges for the preparation of phosphor-copper, used in the production of phosphor-bronze.

The rapid growth in demand for phosphorus can best be illustrated by the fact that whereas the quantity of phosphorus used in the match industry has remained constant since 1914, when it represented 75% of the total U.K. production, in 1959 it represented less than 1%.

Correspondence

The Cancer Articles

To The Editor.

Sir: I take this opportunity to express my warm appreciation of the masterly review article, "Viral and Immunological Aspects of Cancer," by Dr. D. A. Darcy, which appeared in Manufacturing Chemist, June 1960. I have devoted much thought to these aspects of cancer myself and felt perhaps a keener interest than the average of your readers. Whilst I know that you cannot cater for the taste of only one reader, at least I may place on record that if you should feel inclined to have later reviews from Dr. Darcy, I for one would look forward to them.

Yours truly,

W. H. Black,
A.M.T.C. (Chem.), A.R.A.C.I.

Sydney,
Australia.

Data Sorting

To The Editor.

Sir: May I tell you, however belatedly, how greatly pleased I was to read in your June issue the review of my article in the January 15 *Science*, "Machine Searching for Chemical Structures." Your summary of my work was accurate and informative and I'm sure it has been in part responsible for some of the more than 100 responses to the article that have come to me from the United States, Europe, Australia and waypoints.

It has been rather difficult for those of us working with the Wiswesser notation to get a hearing in the United States, so it is a double pleasure to have such a warm review.

Elbert G. Smith, Ph.D.,
Associate Professor of Chemistry.
Mills College, Oakland 13, California.

FERTILISERS and Plant Nutrients

By D. P. Hopkins, B.SC., F.R.I.C.

Fertiliser boom in Britain · Granule size and phosphate response
Determination of potash · Hazards of thermal decomposition
Fertilisers and dairy farming · Iron deficiency and phosphate supply
New fertiliser process

Big increase in fertiliser use

THERE has been an unexpectedly sharp rise in British fertiliser use. Provisional figures for N, P_2O_5 and K_2O consumption in 1959-60 show that, compared with 1958-59, there was a 21·7% rise for N, a 19·2% rise for P_2O_5 and a 13·6% rise for K_2O. The *tonnage* of compounds used went up by 13%; but as each year the NPK content of compounds is also rising, this advance must mean more than 13% in terms of nutrients consumed as compounds. It is not an unsafe assumption that most of the 1959-60 separate expansions for N, P_2O_5 and K_2O were expressed in the tonnage rise for compounds—but with one qualification, the rise in P_2O_5, which is partly attributable to larger supplies of basic slag on the U.K. market.

Readers of these Reports over the past ten years will not be unaware of the need for British fertiliser use to increase, for much evidence of under-use has been put forward. Annual advances of from 5 to 7% in fertiliser nutrient uses have not been uncommon. But the size of the 1959-60 advance will surprise the most optimistic. It cannot be explained by an equivalent rise in arable crop acreage; there was a small rise but not one that could possibly absorb over 20% more nitrogen, etc. The rise in phosphate use is particularly remarkable for this has occurred in the face of much opinion that too much of this nutrient has been used on some of the major crops.

Nor is the expansion due to greater farming confidence, for the Price Review of 1960, which preceded the 1959-60 spring peak of fertiliser dressings, was received with undisguised gloom by the industry.

It requires evidence from 1959-60 surveys of fertiliser practice to elucidate the true causes, and such evidence is not yet available. Meanwhile it must be hoped—particularly as other explanations seem untenable—that much of the increase has gone to British grassland. If so, then years of scientific pleading have at last had an effect.

Stronger compounds

However, an influence that cannot be dismissed as unimportant is the fertiliser industry's steadily increasing provision of "stronger" compounds and the lowering of prices for units of N, P_2O_5 and K_2O. It is possible that many farmers apply the same cwt.-per-acre rates of the modern, more concentrated NPK compounds. Although this would explain some of the increase in nutrient consumption, it would not also explain the 13% *tonnage* increase for compounds. Some of the nitrogen increase could be attributable to the production of the ammonium nitrate/limestone type of "straight" in 21% and 23% grades as well as in the long-used 15·5% grade. Here, too, many farmers may have applied unreduced rates per acre.

A less happy aspect of this expansion is the weather that followed the increased use of fertilisers. The best year in history for fertiliser use was also one of the wettest growing and harvesting seasons on record. Except possibly for sugar-beet, the average crop yields are below recent levels. Most farmers should be practical enough to realise that 1960's unusual weather prevented full returns from their increased fertiliser investment. Even so, they may be discouraged from increasing fertiliser use at so high a rate. If 1960-61 consolidates the advance of the previous year, it is perhaps as much as we can expect.

The use of nitrogen

The 21·7% increase in nitrogen use is of particular significance when related to recent increases in U.K. production capacity. In 1959 the new Shell Chemical Co.'s nitrogen works in Essex (which also, of course, supplies the new Fisons' nitrogen works nearby) added nitrogen production capacity approximately equal to 15½% of national use at that time. At the rate of annual increases in use during the 1950s, it seemed that this expansion would take some three years to absorb. It has been more than absorbed in one year! In fact, the nitrogen production rise for 1959-60 (over 1958-59) was only 12·8%. Also, for the first time for some years, 1959-60 revealed a larger home use of nitrogen (414,600 tons) than home production (395,100 tons). It is not surprising, therefore, that Fisons are to build a large new nitrogen plant. The U.K. fertiliser nitrogen situation must certainly confound those critics who not long ago contended that the price of nitrogen was too high at a time of surplus production.

Granule size

A paper from the Tennessee Valley Authority[1] has reported greenhouse tests to investigate the effect of granule size upon responses to phosphate. For this, mixtures of dicalcium and mono-ammonium phosphate were prepared in varying proportions. Decreases in granule size increased responses to dicalcium phosphate, but they reduced responses to the water-soluble mono-ammonium phosphate. The test

crop was oats. When both kinds of phosphate were present in granules, the effects of size differences broadly reflected a combination of the effects found for the separately applied phosphates; thus, with both kinds equally present in granules, there was no appreciable effect of granule size upon availability or response. These results are very much what might have been predicted—smaller sized particles are better for less soluble forms of phosphate, larger sized particles tend to assist the efficiency of water-soluble phosphate.

A sidelight of the paper is that the response to mixtures was also related to the proportional content of mono-phosphate — further modern indication of the ancient view that water-soluble phosphate has superior effectiveness. It seems a pity that when studies are made of the effects of granule size, the compared materials are not more closely comparable *per se*. Here granule size effects for di*calcium* phosphate and *ammonium* mono-phosphate have been contrasted. Much is said about granule size today, both in terms of size range and size uniformity, but throughout the era of granulation there has been meagre research on the subject. Particularly where NPK compounds are concerned—in which a variety of chemical substances occur—arguments about granule size are largely speculative.

Does granule size, simply for mechanical reasons, have more influence when the type of fertiliser distributor is considered? A recently published British paper[2] has discussed modern techniques for broadcast applications. It was shown that for a 2-cwt. per acre mechanised broadcast distribution, granules could weigh up to 0·3 g. each without affecting efficiency of coverage; as normal granules currently in use weigh about 0·02 g. this question of size hardly seemed significant. However, where more intensive coverage is required, the calculated granule weight is necessarily lower; even so, the difference between 0·3 and 0·02 g. seems large enough to exclude significant effects from granule size variations. The conclusion of the paper was that "there is at present no reason to believe that granule sizes currently adopted need alteration." As in this country most recent argument about granule size has centred on dressings of broadcast kind made with spinner-distributors, this paper from the National Institute of Agricultural Engineering is reassuring, and should help to lessen expenditure upon the pursuit of fertiliser refinements that are unimportant in cropping.

Potash determinations

The faster and more reliably that soil analyses can be carried out the more they help advisory work with fertilisers. A new British paper[3] has described a method for determining potash in soils by Geiger-Müller tube counts of the ^{40}K isotope, whose presence in natural potassium in the proportion of 0·0119% is almost constant. The count rates for soil samples were calibrated with results from mixtures of quartz and minerals of known K content.

Thirty-eight soils in Britain and Spain were tested and 26 in central, south and eastern England gave results 0·19% higher than results from two chemical methods; but for the 12 other soils (Spain, Wales and Scotland) the differences between the isotopic and chemical methods were larger. The standard error from duplicate measurements for this new method is about three times that for chemical methods. The method is speedy but so, too, is the flame photometric method, though with soils silicates must first be removed for the latter. A point not made in the paper is that error due to soil sampling considerably exceeds any range of error likely in laboratory testing; if this is borne in mind, does the lower precision of the ^{40}K method really matter so much?

Thermal decomposition hazards

A paper from the U.S. examines hazards of high analysis compounds when they are exposed to heat.[4] Reactions that can occur after a certain ignition temperature has been reached are discussed. Some of these reactions are powerfully exothermic. Not only is there a risk that much stored fertiliser will itself be destroyed, but a more serious danger arises from toxic gas evolution.

The tendency to relate risk of thermal decomposition to a mixed fertiliser's content of ammonium nitrate is not wholly sound—the presence of chloride is also an influential factor. Not only is chloride a catalyst for ammonium nitrate breakdown reactions, but it can react with the nitrate as follows:

$$4NH_4NO_3 + 2NH_4Cl \longrightarrow 5N_2 + Cl_2 + 12H_2O$$

This reaction is about ten times as exothermic as the decomposition of ammonium nitrate into nitrous oxide and some six times as exothermic as ammonium nitrate's breakdown into nitrogen and oxygen. Three 12-12-12 compounds made by different processes; two 16—8—8 compounds, one containing urea; and a 15—0—14 mixture were examined. Spontaneous ignition occurred with all of them within an hour at a temperature range of 410° to 482°F. Only three ignited spontaneously (and more slowly) at 302°. None ignited at 266°. There were remarkable variations in the composition of gases evolved from the 12-12-12 compounds, these variations apparently being associated with the processes of manufacture; this was found for gas evolution under pre-ignition thermal conditions.

The problem of continued or self-sustained decomposition is somewhat complex. If the breakdown reaction generates ample heat for its own propagation, the initial temperature of the pile of fertiliser is unimportant—once an accidental source of heat has started an ignition, steady expansion of the reaction through the stored pile may be expected. If the reaction generates barely enough heat for its propagation, then self-sustained combustion can proceed only if the pile was initially hot. Four of the six fertilisers, after artificial ignition, could continue to "burn" with an initial pile temperature of only 95°F. The 15—0—14 grade required an initial pile temperature of 176° for this to occur; but the batch-ammoniation-produced 12-12-12 grade was safe even at this higher pile temperature. Thus, some compounds, given any risk of ignition at some point in a storage pile, are far more prone than others to extensive thermal loss at pile temperatures not uncommon under summer conditions.

Fertilisers raise milk yields

Success stories of farms where fertilisers are heavily used are frequently cited today, but one recently described[5] merits discussion. The farm has an exposed site 1,000 ft. above sea level in the Yorkshire Pennines, with poor soil. In 1938 milk production was based upon heavy feeding of concentrates; at their low cost then, the expenditure was 5½d. per gal. of milk, but at present-day prices this would now be 1s. 9½d. After the war the farmer devoted steadily progressive attention to grass utilisation. By 1948, 48

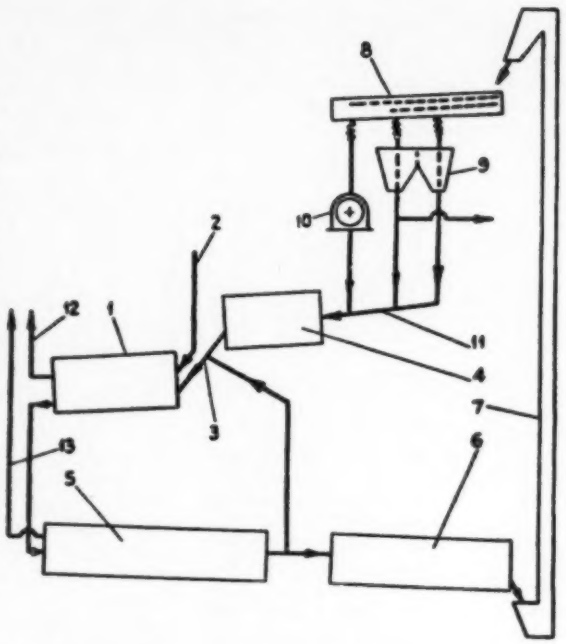
instead of 101 tons of concentrates were used per year, and the use of 19½ tons of fertilisers had been developed. The cost of concentrates plus fertiliser came to 1s. 1d. per gal. (in terms of current prices). By 1957, concentrates use had been reduced to 20 tons per year and fertilisers were used at 46 tons per year. The cost per gal. of milk for concentrates and fertiliser had come down to 9¾d. a gal. A more recent figure (1958) is 9d. a gal., 54 tons of fertilisers being used. The farm is 85 acres in area. It is standard annual practice to apply 4 cwt. an acre of a concentrated compound to all the fields, followed by 3 cwt. of a nitrogenous fertiliser a few weeks later.

Further nitrogen or nitrogen-potash dressings are given before the autumn to fields after each grazing or after each cut for silage. In 1959 this farm's gross output was £121 an acre and its net output £89 an acre; both these figures are more than double the average gross and net outputs for *lowland* dairy farms costed by the Universities' Economics Departments. But this is an exposed-site upland farm. Sixty cows are kept on the 85 acres, which is as high a stocking rate as when milk production there was based almost entirely on cheap imported concentrates. All but 3 acres of the grass are leys of 2-3 or 4-6 years' life; and 5 to 6 acres of kale are grown as fodder. Intensive fertiliser use, grazing and heavy production of silage from cut grass, have together led to these outstanding results.

Phosphate-iron antagonism

An unusual paper[6] reports a case of iron deficiency induced by phosphate supply. It deals with the blueberry (also known as bilberry) plant which characteristically grows well on acid soils; in the U.S.A. it is a crop grown more commercially than here. Culture growth studies of the blueberry showed that at a *p*H of 4, plants suffer from phosphate deficiency owing to the effect of this *p*H upon phosphate availability; but when, to offset this, higher amounts of phosphate were given, iron cholorosis symptoms were displayed. This was attributed to the formation of iron phosphate which even at *p*H 4 has a very low solubility.

At a *p*H between 4 and 5 phosphate deficiency troubles were fewer, and it would seem that enough phosphate could be present and available without also having present an excess of phosphate that would remove all the iron. Plants grown at a *p*H higher than 5 suffered with increasing severity from iron chlorosis, showing that at this *p*H, though more favourable for phosphate availability, iron became too unavailable. This indicates the special difficulties in nutrition of acid-liking crops. However, the iron deficiency symptoms could be speedily corrected even at the unfavourable *p*H levels by adding chelated iron compounds (Fe—EDDHA).



Flow sheet for production of potassium metaphosphate. 1. Reactor. 2. Raw materials feed. 3. Re-cycle material feed. 4. Re-cycle heater. 5. Counter-current heated rotary kiln. 6. Counter-current rotary cooler. 7. Elevator. 8. Separating screens. 9. Product hopper. 10. Cracker for oversize material from 8. 11. Conveyor. 12 and 13. Hydrogen chloride removal ducts.

S.A.I.'s new process

Scottish Agricultural Industries Ltd. have patented a new process for making granular potassium metaphosphate from phosphoric acid and potassium chloride.[7] The correct formula for potassium metaphosphate is not KPO_3 but $(KPO_3)_n$, for it exists as a condensed molecule and the phosphate is water-insoluble.

In the new process the reactant materials are added to a hot preformed and circulating bed of product particles, and the reaction product forms a thin skin upon each particle; the reaction is completed quickly at about 450°C. For fertiliser use of the end-product, relatively impure raw materials may be used. The reaction is

$$nH_3PO_4 + nKCl \longrightarrow (KPO_3)_n + nHCl + nH_2O,$$

and HCl is recovered in the S.A.I. process. Many tests have already shown that the phosphate content, though water-insoluble, is close in value to water-soluble phosphate.

Most former processes have had the disadvantage of needing a higher operative temperature, *e.g.*, 900°C., and the product was of inconvenient physical form, a solidified melt. A typical analysis of the S.A.I. product is 57% P_2O_5 and 37% K_2O. It is considered that the savings made possible through this high concentration offset the slightly higher processing costs involved. The granular form is free from caking tendencies. Mixing with ammonium nitrate or urea as a nitrogen source is considered the best way of utilising this new fertiliser material for making highly concentrated NPK compounds. The ammonium nitrate in a wet-granulation process brings about water-solubility for the phosphate and in the final product as much as half of the total P_2O_5 may become water-soluble by hydrolysis.

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THERAPEUTICS

By S. J. Hopkins, F.P.S.

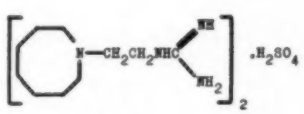
New drugs for circulatory disorders • Trichomoniasis • Oral antidiabetic drugs for eye disorders • Diuretics • Cytostatics • Tranquillisers • New antibiotics

Circulatory disorders

MANY of the newer drugs now available for the treatment of hypertension are more specific in action, and are free from the undesirable side effects of the ganglion blocking agents. Dollery[1] *et al.* have treated a series of 80 patients with one of the most promising of the orally active compounds, namely guanethidine, with particular reference to its absorption, action and excretion.

Guanethidine

Guanethidine, or 2-per hydroazocin - 1′ - yl - ethylguadinium sulphate, (1) like bretylium, does not affect the transmission of parasympathetic impulses, so that side effects such as dryness of the mouth and constipation are insignificant, but the main advantage of the drug appears to be that the hypotension produced is more consistent. In the more severe cases of hypertension treated with bretylium, some patients may become resistant to the drug, and this resistance may be sudden in onset.



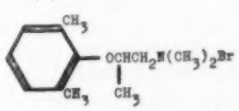
(1)

Guanethidine has been compared with bretylium from this point of view by Evanson[2] and Sears, who consider the drug to be much more satisfactory, particularly when treating outpatients. A single daily dose was found adequate, and in their series of 16 patients only one was regarded as a failure, whereas in a contrasting group of 25 patients treated with bretylium, 16 were not fully controlled, supplementary therapy with chlorothiazide, reserpine and potassium chloride frequently being necessary. A study of the relative effects of bretylium and guanethidine by Taylor[3] and Donald also indicated that the two drugs do not have an identical hæmodynamic action, as guanethidine causes less fall of blood pressure during exercise. Work on the pharmacology of guanethidine is also the subject of reports by Maxwell[4] *et al.* and Danellis[5] and Zaimis.

Sympatholytics

An interesting series of 2·6-disubstituted phenoxyethyl ammonium compounds with sympatholytic properties have been reported on by Mclean[6] *et al.* Work on this type of compound is not entirely new, as an earlier study was made in 1953 by Hey[7] and Willey on a similar compound with local anæsthetic properties, but the new derivatives may have applications in the treatment of hypertension.

In general, the compounds examined by Mclean exhibit a slowly developing but long lasting inhibition of the adrenergic nerves, although some compounds also have marked muscarinic properties. The action can be modified by side-chain substitution, as both α and β-methylation reduce the muscarinic effects, but with the α compounds this also results in a less specific sympatholytic action. The most effective orally active derivative examined was 2·6-dimethyl-β-methylphenoxyethyl dimethyl ammonium bromide (2).



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The investigators suggest that compounds of this type may act by preventing the formation of noradrenaline from its immediate precursor, or by reducing the level of the catechol amines present at adrenergic nerve endings. The drug has a consistent long-lasting action, and may prove of value in the hypertension of peripheral vascular disease.

Work with a very different group of drugs is the subject of a preliminary report by Biel[8] *et al.*, using the hydrazine analogues of certain known effective drugs such as hydrallazine.

Hypoglycæmic agents

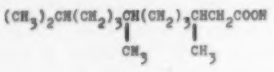
In other circulatory disorders such as thromboembolic disease, Fearnley[9] *et al.* have suggested that an increased fibrinolysis may prove a more rewarding therapeutic measure than attempts to reduce coagulation. In diabetics a biphasic change in the fibrinolytic action of the blood may occur after an injection of insulin, and the effects of the orally active sulphonylureas, used as hypoglycæmic agents, were therefore tried out in non-diabetics. A similar increase in fibrinolytic activity was noted, following the administration of tolbulamide or chlorpropamide, but was unrelated to any hypoglycæmic action. Some other mechanism must also be involved, as the magnitude of the response was related to the previous fibrinolytic level.

This method of increasing spontaneous fibrinolysis has considerable potential value, and is supported by the experiences of Singh[10] and Brara. These workers found that a dose of 0·5G of tolbutamide thrice daily relieved the agonising pain of thromboangiitis obliterans. In this condition the inflammation of the veins and blood clot formation causes pain and gangrene, the former being so severe that even powerful analgesics are ineffective, and amputation of the affected limb may be necessary. In a series of 36 cases, spectacular relief was obtained in 34, and clinical remission was maintained in a few for over two years. The drug appears to have some anti-inflammatory action, but the mechanism has yet to be discovered.

Lowering cholesterol levels

Reference has been made in earlier reports to the influence of nicotinic acid in lowering blood cholesterol in athero-sclerosis and other ischæmic heart diseases. Goldsborough[11] has used both the acid and the amide in acute myocardial infarction with good effect, and points out that although results

depend on the degree of thrombosis, they cannot depend on vasodilator action alone. He makes the interesting suggestion that the condition may be a deficiency disease. An alternative therapeutic possibility is that of inhibiting the biochemical synthesis of cholesterol. Popjak[12] *et al.* has pointed out that the very complex chain of synthesis could be interrupted at several stages, and suggests that analogues of farnesoic acid might function as antimetabolites. Carboxylic acids such as farnesoic inhibit the use of intermediates in cholesterol synthesis, and 3.7.11-trimethyl dodecanate (3) was found to block cholesterol synthesis completely.



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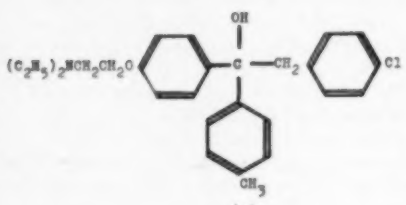
A method of decreasing endogenous cholesterol has therapeutic possibilities, and clinical experiences on these lines have been reported by Hollander[13] *et al.*, using triparanol or MER-29 (4). This compound,



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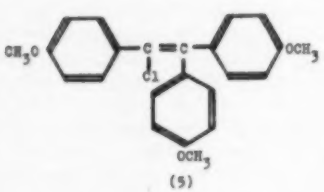

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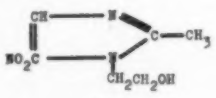
1-[4(diethylaminoethoxy)-phenyl]-1-(*p*-tolyl)-2-(*p*-chlorophenyl) ethanol, is a triphenyl ethylene derivative, and is chemically related to the œstrogen chlorotrianisene. It inhibits cholesterol synthesis in patients with normal and those with raised blood cholesterol levels. In the latter, the reduction achieved was generally in proportion to the degree of hypercholesterolæmia. The drug was given in daily doses of 250 mg., and in a series of 89 patients a satisfactory response was shown by 71. Increasing the dose of triparanol had little effect. The drug was well tolerated and no œstrogenic effects were observed, as might be thought possible in view of the structural resemblance to chlortrianisene (5).

Trichomoniasis

This condition, which is due to infection with *Trichomonas vaginalis*, has always been difficult to treat, and apparent cures are often followed by relapses. It is now recognised that males may often harbour the parasites, as well as females, and this may account for many re-infections and relapses. Systemic rather than local therapy would appear to be the logical treatment, but the drugs used in the past have not proved efficacious. Encouraging successes, however, have been obtained with a new orally-active compound, 1-*β*-hydroxyethyl - 2 - methyl - nitro imidazole, also known as metronidazole (6).



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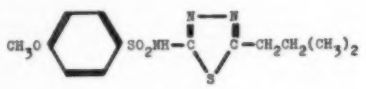
Significant amounts of this substance are found in both blood and urine after oral administration, and Durel[14] *et al.* used it in a short series of patients with success. Following this, Watt[15] and Jennison tried the drug in 50 patients with non-specific vaginitis, in all of whom *T. vaginalis* organisms were found. The drug was given in doses of 200 mg. three times a week, at first on a double-blind trial scheme. This blind trial was soon abandoned, as the results of treatment with the drug were obvious. No local treatment was given. Good results were obtained by Rees[16] and also by Moffett[17] and McGill. The few patients who failed to respond to metronidazole treatment may have had some inability to absorb the drug in sufficient amounts.

Diabetes

The use of oral hypoglycœmic drugs such as tolbutamide and chlorpropamide in the treatment of diabetes mellitus is now established, although alternative compounds continue to be sought. Among compounds already described is 2-sulphamido - *p* - aminobenzene - 5 - *ter* - butyl - 1.3.4 - thiadiazole, but this substance proved too toxic for therapeutic use. More recently Healy and Arneaud[18] have examined the methoxy *iso*butyl derivative (7), and in a series of 33 patients, half were controlled better by the drug than by insulin, and nine were equally well on either. Response in the others was less satisfactory, but for selected patients, and in areas where clinical facilities are restricted, as well as where transport alone is a major problem, this orally-active compound has considerable advantages.



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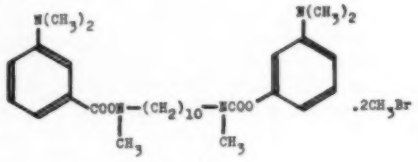
Ophthalmology

The use of cholinesterase inhibitors to reduce intraocular tension is well known, and although the alkaloid physostigmine (eserine) is usually effective, more powerful drugs are often required. Krishna[19] and Leopold have described clinical experiences with BC48, or decamethylene - bis - (*m* - dimethyl - aminophenyl - N - methyl carbamate) dimethobromide (8). This



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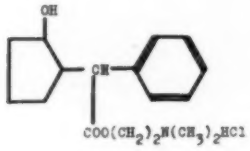
compound, also known as demecarium bromide, has certain muscarinic properties by virtue of its quaternary ammonium structure, but is of clinical interest as a powerful inhibitor of cholinesterase. It is soluble and stable in water, and when applied to glaucomatous eyes it has an intense and prolonged action, and can reduce intraocular pressure even when the eyes fail to respond to other drugs. This effect on ocular pressure is not affected by the previous use of physostigmine, so that the drug may be reserved if required for later use. The anticholinesterase action of demecarium is so powerful that the drug is suitable for local ophthalmic use only, and care must be taken to prevent absorption from the skin.

Some new mydriatics have also been investigated. Priestley[20] *et al.*, using

β - dimethylaminoethyl - (1 - hydroxy cyclopentyl) phenyl acetate (9), found that the compound has a rapid action, which is not associated with any increase of intraocular pressure, and can be reversed easily and completely if required by pilocarpine. Another compound referred to as RO-1-7683-15, was tried out by Nano[21] *et al.* A 0·5% solution had a rapid action, similar to but stronger than that of homatropine, and the eye returned to normal in less than half the usual time. The compound, which is described chemically as N-ethyl-N-(γ-picolyl)-tropamide hydrochloride (10), had the advantage of not causing any rise in the intraocular pressure.



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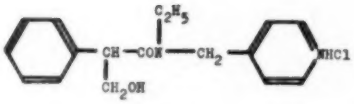

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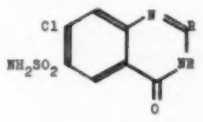
An orally active compound for lowering intraocular pressure, referred to as methazolamide or Neptazene, has been described by Becker[22] and also by Kandom[23] *et al.* This drug, which like the earlier acetazolamide acts by inhibiting the enzyme carbonic anhydrase, has the following structure (11).

(11)

In doses of 100 mg. twice daily it was effective and had few side effects, and may be of value for long-term therapy, especially for patients who cannot tolerate other compounds.

Diuretics

The great value of the new oral diuretics has led to a new interest in a number of heterocyclic compounds. The derivatives at present in use have a ring-S-1-1-dioxide structure, but Cohen[24] *et al.* have questioned whether this grouping is essential for diuretic activity. These workers have investigated a series of 7-chlor-6-sulphamyl-4-(3H) quinazolinones (12) and the corresponding 1.2.3.4-tetrahydro-4-quinazolinones. In

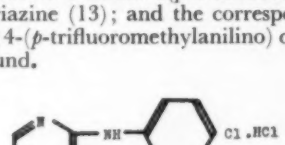


(12)

these compounds the ring SO_2 group is replaced by a carbonyl group, often with increased diuretic activity. In the 1.2.3.4-tetra hydro compounds there was generally a reduced K/Cl ratio, although this could be reversed if low molecular weight alkyl groups were substituted at the 3-position. This paper also gives methods of synthesis.

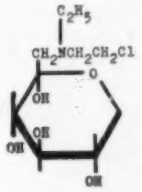
Cytostatics

The influence of the hormones of the pituitary gland and of the adrenal cortex on physiological and metabolic processes are well known, and adrenal-pituitary depressants have a potential value as anti-cancer drugs. A number of compounds exhibiting such depressant activity are known, including amphenone, chlorpromazine and reserpine, but Costa[25] and Bonneycastle have found anti-androgenic properties in 2-amino-4(*p*-chloranilino)-*s*-triazine (13); and the corresponding 4-(*p*-trifluoromethylanilino) compound.



(13)

These compounds caused a marked reduction in the excretion of urinary cortico and 17-keto-steroids, and also inhibited the androgenic action of testosterone. Compounds of this type have considerable potential value as cytostatics in certain types of neoplastic disease. Anti cancer drugs are also being sought for among enzyme inhibitors. A compound of a suitable chemical structure could fit a specific enzyme receptor site. If such a substituent compound had an alkylating group, it might replace an adjacent active hydrogen atom by alkylation, thus causing an irreversible blocking. Reist[26] *et al.*, working on these lines, consider that an active cytostatic could be used in this way, if attached to a suitable carrier. The effect of certain sugars as carriers of nitrogen mustards is known, and encouraging results have been obtained with mannomustine, which is a compound of this type. Reist and others have synthesised a number of monochlorethylamine derivatives of various sugars on these lines. Many of these compounds are unstable, but a stable derivative of the following structure (14) is being subjected to further study.



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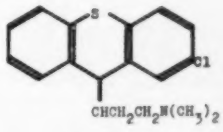

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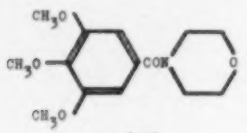
Tranquillisers

The search for neurosedative drugs has resulted in the study of many different compounds, and a thioxanthine derivative described by Pellmont[27] *et al.* both resembles and differs from those of the promazine type. This new compound (15), described as 2-chloro-9(3-dimethylaminopropyliden) - thio - xanthene or Taractan, has a powerful central depressant action, yet has little hypnotic effect. The dose is about half that of chlorpromazine, but the drug also has the advantage of not causing any significant degree of tremor or other parkinsonism symptoms. The absence of this side effect appears to be associated with the anticholinergic activity, and the drug is of further interest as indicating that a phenothiazine ring is not essential for neurosedative compounds. Neurosedative activity has also been shown by Borsby[28] to be present in various trimethoxy phenyl

compounds. This grouping is found in reserpine, mescaline and colchicine, and with the synthesis of reserpine, associated compounds were examined as possible neurosedative drugs. One of the most active was trioxazin, or N-(3.4.5-tri - methoxybenzoyl) - tetrahydro - 1.4.-oxazine (16). This compound

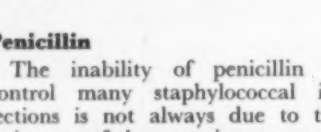


(16)

has chemical relationships with the hallucinogen mescaline, and its action appears to be exerted on various cortical and sub-cortical tissues of the brain, as it is unable to antagonise the action of strychnine on the spinal cord. There is a wide margin between the tranquillising dose and that producing muscle weakness.

Penicillin

The inability of penicillin to control many staphylococcal infections is not always due to the resistance of the organisms as such, but to the formation of the enzyme penicillinase. This enzyme rapidly hydrolyses penicillin to the inactive penicilloic acid, so that the organisms escape attack by the antibiotic. The work of Batchelor[29] *et al.* in isolating 6-amino-penicillanic acid indicated that new derivatives of penicillin could now be prepared by the introduction of side chains. A number of such compounds have since been prepared, some of which had little antibacterial activity, but the sodium salt of 6-(2.6-dimethoxy benzamido) penicillanic acid (17)



(17)

was found to be highly active against penicillin - resistant staphylococci. This compound has been tried out clinically by Douthwaite[30] and Trafford and Stewart.[31]

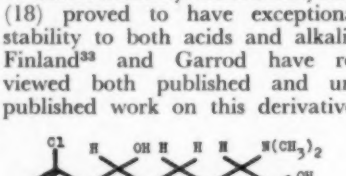
In a series of patients with infections caused by penicillin-resistant staphylococci, the new compound was found to be consistently

Chemical pilot plant at Beechams' research laboratories at Brockham Park showing reaction vessels in which 6-amino penicillanic acid is modified to make new penicillins.

effective, and the infection was soon controlled. No side effects were marked enough to limit treatment, and preliminary experience suggests that the new compound will be a most valuable drug. It is not effective orally, as it is inactivated in the stomach, but must be given by injections, which are usually painful.

Tetracycline derivatives

A modification of the structure of the tetracyclines has also resulted in an increased activity. McCormick[32] *et al.* prepared some demethylated analogues of the four tetracyclines, of which demethyl-chlortetracycline (18) proved to have exceptional stability to both acids and alkalis. Finland[33] and Garrod have reviewed both published and unpublished work on this derivative,



(18)

and point out that it has almost twice the anti-bacterial potency of tetracycline, together with a lower rate of renal clearance.

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American Commentary

NEWS AND VIEWS OF THE U.S. PHARMACEUTICAL INDUSTRY **by Rolf Silken**

Changes in timetable of FDA regulations ★ New system for checking side-effects of drugs ★ Second thoughts on Imferon ★ Doubts about chloromycetin—warning issued ★ The new drugs of the past twelve months.

IT'S EASIER to write regulations than to enforce them. The Food and Drug Administration which recently swamped the American pharmaceutical industry with new rules and policy statements—many of them justified but others too strict or too complicated and costly—recognised the impossibility of enforcing all of them speedily and granted numerous last-minute reprieves. There were also too many conflicting opinions and interpretations given, even by top FDA men, when asked to clarify the new rulings.

These are the new dates on which the following regulations will become effective:

March 9, 1961—Dating of all promotion, brochures, and package inserts: They must carry issuance date or date of last revision of the text.

June 6, 1961—Coding of all drug labels and cartons with lot (or control) numbers.

August 1, 1961—Hazardous Substances Labelling Act: The penalty provisions of this act have been suspended until August 1 for all but flammable and " highly toxic " substances, such as caustic poisons, methyl alcohol, and carbon tetrachloride.

January 8, 1962—Mandatory information on labels: If printed before January 8, 1961, they may be used up, provided a package insert is made available giving full information about dosage, route of administration, and quantitative listing of the active ingredients of parenteral and ophthalmic prescription drugs.

In a new interpretation of this regulation the FDA made it clear that in future inactive ingredients are to be listed qualitatively on ophthalmic products, and quantitatively on parenterals, the only exception being water for injection or chemicals added to adjust the *p*H or to make the drug isotonic. Flavours, perfumes, certified colours and traces of harmless substances added to identify prescription drugs for other than oral use do not need to be listed at all.

January 8, 1962—Mandatory information in catalogues: If printed before January 8, 1961, they may be sent to pharmacists and wholesalers, but not to physicians.

Open End Time Extension—Food Additive Law: In a final act, the Eisenhower administration approved proposed legislation extending the effective date past March 6, 1961, and suggested granting individual chemicals an extension for any period of time deemed necessary. It is expected that this bill will be accepted by Congress unchanged or by replacing the open end arrangement with a general one-year extension.

Already effective as of February 15, 1960, are these new FDA rules.

(1) Full disclosure on all prescription drug promotions, including house organs. In fact, it is expected that the FDA very soon will start to check drug promotion material mailed to physicians for full disclosure on side-effects, contra-indications and warnings.

(2) Plant inspections before NDA (New Drug Application) approval.

(3) The Colour Additive Law, now put in effect, establishes a petition fee ranging from 2,600 to 3,000 dollars for each colour to be certified for use in foods, drugs and cosmetics. When pharmacological work is to be undertaken by the FDA, an advance of 5,000 dollars is to be made which will be accounted for, and refund made if not used up, after the actual cost of the investigation has been determined.

Drug reactions check

The FDA is on the look-out for adverse drug reactions. A reporting programme is being maintained which at present consists of 17 major teaching hospitals and 15 U.S. Public Health Service hospitals. Their physicians report regularly on drug reactions and these reports are compiled and reviewed by FDA experts to determine whether the observed side-effects are of a nature which may require warning statements or even prohibition of the use of the drug.

Some FDA experts suggest now the formation of a reporting system for cosmetics, to determine the extent of allergic and other untoward skin responses, as well as precautionary measures, if they should become necessary.

Imferon rehabilitated?

Iron-dextran (Imferon) may again become available. This drug was taken off the market in Great Britain because it was suspected to cause cancer in laboratory animals. Lakeside Laboratories, the American licensee of the British patent holder, Benger, also stopped selling the drug for use by physicians (the large sales of the same drug by another firm for use in baby pigs were never discontinued). Now, the mighty American Medical Association has requested that the drug be made available again, since only a single " questionable " case of cancer has developed over a period of six years in which it was used by physicians. The AMA emphasizes that iron-dextran injections are often preferable to orally administered iron. The FDA is now reviewing the new data and revised label text submitted in a supplement Imferon NDA which was suspended on request of the American manufacturer at the height of the cancer scare.

Chloromycetin warning

Chloromycetin, or chloramphenicol, is a valuable but apparently dangerous drug. Recently, two lawsuits for $250,000 each were filed against its manufacturer (Parke, Davis). A panel of National Research Council experts has now reported to the FDA that a national survey of case histories makes it necessary to revise the labelling of this antibiotic.

This is the text (abbreviated) of the new warning now required for this drug: " Serious and even fatal blood dyscrasias (aplastic anæmia, hypoplastic anæmia, thrombocytopenia, granulocytopenia) are known to occur after the administration of chloramphenicol. Blood dyscrasias have occurred after short-term and

(Continued on next page)

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with prolonged therapy with this drug . . . Chloramphenicol should not be used when other, less potentially dangerous agents will be effective or in . . . colds, influenza, viral infections of the throat . . . Precautions: It is essential that adequate blood studies be made during the treatment with the drug . . . such studies cannot be relied upon to detect bone marrow depression prior to development of plastic anæmia."

New drugs

New pharmaceuticals synthesised in the U.S.A. and marketed in 1960 include the following:

Adrod, or oxymetholone, a hormone, (Parke, Davis)
Alvodine, or piminodine, a narcotic (Winthrop)
Analexin, or phenylramidol hydrochloride, an analgesic and muscle relaxant (Irwin-Neisler)
Brevital, or methohexital sodium, a short-acting anæsthetic (Lilly)
Carbocaine, or mepivacaine hydrochloride, a local anæsthetic (Winthrop)
Cardioquin, or quinidine polygalacturonate, a cardiac depressant (Purdue Frederick)
Dianabol, or methane dostenolone, a hormone (Ciba)
Didrex, or benzphetamine, an appetite depressant (Upjohn)
Dornwal, or amphenidone, a tranquilliser (Maltbie)
Elipten, or aminoglutethimide, an anticonvulsant (Ciba)
Enduron, or methyclothiazide, a diuretic (Abbott)
Glucagon, a hypoglycæmic (Lilly)
Humatin, or paramomycin, an antibiotic (Parke, Davis)
Hygroton, or chlorthalidone, a diuretic (Geigy)
Ismelin Sulfate, or guanethidine, a hyposensitive (Ciba)
Librium, a tranquilliser (Roche)
Mer/29, or triparanol, a hypocholesterolæmic (Merrell)
Miradon, or anisindione, an anticoagulant (Schering)
NaClex, or benzthiazide, a diuretic (Robins)
Naqua, or trichlormethiazide, a diuretic (Schering)
Staphcillin, or dimethoxyphenyl penicillin (Bristol)
Timovan, a tranquilliser (Ayerst)
ULO, or chlorphedianol hydrochloride, a cough remedy (Riker)
Zarontin, or ethosuximide, an anticonvulsant (Parke, Davis).

Chemicals in the Commons

Drug Profits Wrangle

By Our Westminster Correspondent

AMERICAN pharmaceutical companies had invested in this country—through research—more than they had so far taken out, said Sir Tufton Beamish (Conservative, Lewes) in a Commons debate last month on the new National Health Service charges.

He was defending the drug firms against Opposition attacks of "exploitation of the Health Service" and "inflated profits."

Sir Tufton, saying that he was on the board of the British subsidiary of an American firm, declared that if people wished to be fair to a firm whose profits they were criticising they should take into account the research carried out by that firm. In America last year more than 150 million dollars was devoted to research. Referring to criticism of the cost of drugs, he said the Board of Trade wholesale price index for pharmaceuticals rose by only 1·4% in the five years 1954–59, whereas during the same period the index for all manufactured products rose eight times as much. The cost of prescription drugs here was one of the lowest in the world, he asserted. Among Labour critics of the drug companies was Mr. Kenneth Robinson (St. Pancras, N.), who said that the U.S. firms had been forcing the pace in promotional expenses. One American firm was estimated to have 600 representatives calling on doctors at a cost of about £750,000 a year. There were over 2,200 representatives of drug manufacturers going around the country—one for every ten doctors.

Mr. Maurice Edelman (Labour, Coventry, N.) said: "The N.H.S. has been milked by these drug companies, both British and American, as if it were some great placid cow whose object was to nourish profits instead of sustaining the health of the nation." The average cost of prescriptions had risen from 3s. 1d. in 1949 to 7s. 4d. in 1960. Saying there were 17 American-controlled companies in Britain making prescription drugs, he added: "We have to ask ourselves whether the shareholders of those American companies are growing fat on money made from the sick and ailing in this country." Giving examples of profits on drugs, Mr. Edelman claimed that the manufacturers of *Inverscine*, extensively used in the treatment of hypertension, had at one time been making a profit out of the Health Service of "something like 1,000%." The amount of profit had since been reduced and today was only 500%, he added.

The Government spokesman, Mr. John Maclay, Secretary of State for Scotland, said that the new voluntary price regulation scheme accounted for about 85% of the cost of all drugs. Doctors were being given as much information as possible on how to prescribe efficiently and economically. A new journal had been produced by outside experts, giving doctors objective valuations of new drugs.

The drug bill was also raised at question time. Mr. Enoch Powell, Minister of Health, stated that the gross cost of the pharmaceutical services in Great Britain was about £92 million in the current year, compared with about £50,750,000 in 1951-52. Prices of individual drugs had not generally increased, but many expensive drugs were now prescribed which were not available in 1951-52.

More research, so that doctors should be given only authoritative information about the most effective drugs, was called for by Baroness Summerskill (formerly Dr. Edith Summerskill) in the Lords.

Successful clinical trials of drugs should be the sole criterion, she said. "There are still those—knowledgeable people—who think that the new, expensive antibiotics are infallible. People should be told that already, in consequence of using these antibiotics for trivial complaints, we are left with resistant organisms which today defy antibiotics."

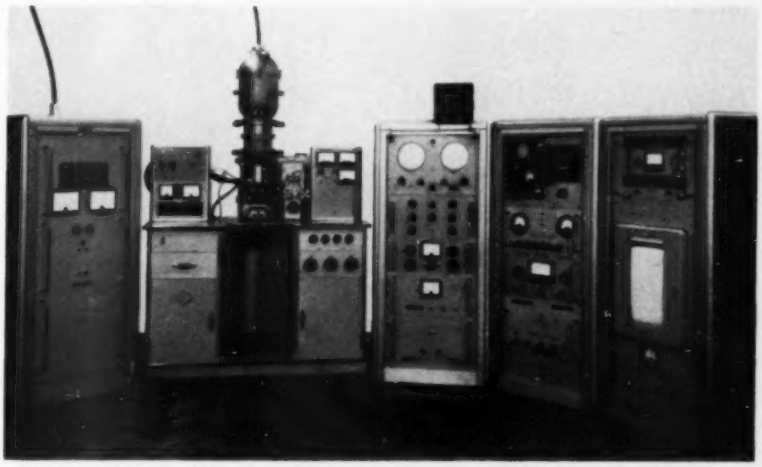
The British Medical Association had confirmed the suspicions of many viewers by stating that a number of medical advertisements on I.T.V. were bogus and misleading and by recommending a ban on drug advertising on television, said Mr. Christopher Mayhew (Labour, Woolwich, E.). He urged the Postmaster-General to take action. Mr. Reginald Bevins said the I.T.A. was governed by the advice of its advertising advisory committee which included representatives of the B.M.A.

▶DRUG MILL

The Manesty drug mill is a cone type machine, in which an inner cone revolves within a stationary one at about 300 r.p.m. Both the grinding faces are grooved, and their distance apart, the product size determinant is adjustable by means of a thumb-screw.

Material is fed from a hopper above into the space between the two cone faces. A breaker bar, which turns with the inner cone, projects upwards into the hopper and assists feeding.

This type of mill is simple, robust and inexpensive and is useful for reducing dry, crystalline and granular agglomerations, tablet rejects, etc.



The Cambridge Microscan X-ray analyser which has an accuracy for quantitative analysis of ±1% which reduces, under favourable conditions, to 0·1%.

▶X-RAY MICROANALYSIS

The Cambridge Instrument Co.'s *Microscan* X-ray analyser is now in full production.

The technique of X-ray micro-analysis consists of focusing an electron beam, normally accelerated from 0 to 50 kV, on to a region of the specimen surface approximately 1 μ in diameter and rather less in depth, and analysing spectroscopically the resulting X-rays excited from the specimen. So far, the technique has been used almost exclusively for research work on metallurgical problems, although it also has applications in biological and other fields.

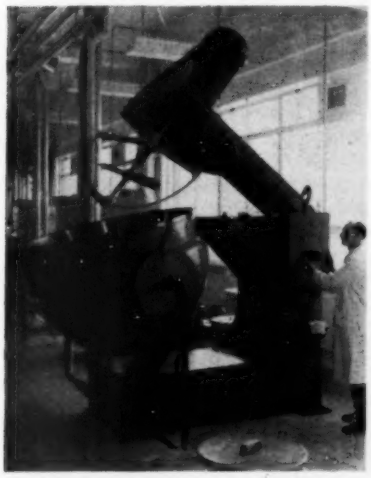
As well as static probe point-by-point quantitative microanalyses, the Cambridge instrument can be used for scanning the surface of the specimen over an area up to $\frac{1}{2}$ mm. $\times \frac{1}{2}$ mm. The characteristic X-rays from any single element (with atomic number 12 or greater) can be selected by a crystal spectrometer and detected by a proportional counter. The signal from the counter modulates the brightness of a beam scanning a cathode-ray tube, in synchronism with the probe scanning the specimen, and forms an image corresponding with the area scanned and showing semi-quantitatively the distribution of the chosen element.

Some of the back scattered electrons from the surface of the specimen strike a scintillation counter, the signal from which modulates the beam of a second cathode-ray tube to form a reflected electron image of the region. This image is similar in its quality of contrast to an optical image photographed by oblique illumination and shows topographical details.

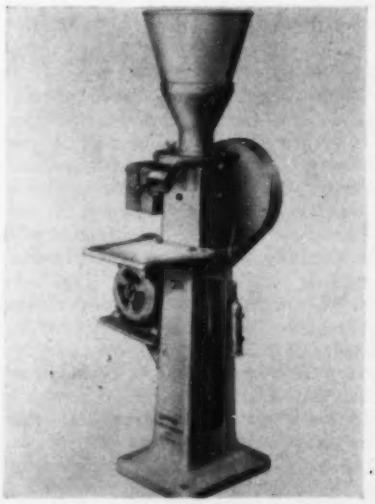
The magnification, for both images, can be controlled from 250 to 3,000 $\times$, and the resolution is normally about 1 μ although this can, under good conditions, be reduced to $\frac{1}{2}$ μ for the electron image.

The accuracy for quantitative analysis is to ±1%, which reduces, under favourable conditions, to 0·1%.

The minimum concentration that can be detected under good conditions is 0·1%, corresponding to a mass sensitivity of about 10^{-14} gm.



A 200 gal. steam jacketed tilting pan built by T. Giusti and Son Ltd. This pan, which has been designed to meet the special requirements of Helena Rubinstein Ltd., is believed to be one of the largest of its type to be built in Britain. It is push-button operated and has a counter-rotating agitator unit with four-speed drive. The agitator assembly is lifted by a motorised hydraulic ram. Tilting of the pan is effected by a hand wheel and gear mechanism.



The Manesty drug mill, which is a simple and robust machine for reducing dry, crystalline and granular agglomerations, tablet rejects, etc.

Forgrove National BW-6 machines used by Smith and Nephew (Textiles) Ltd. for overwrapping surgical dressing cartons.

▶OVERWRAPPING IN CELLULOSE FILMS

Smith and Nephew (Textiles) Ltd., Lancs., are using two Forgrove *National BW*-6 machines each of which is capable of overwrapping 14 different sizes of carton, from 4½ in. long up to 18¼ in., containing cotton-wool, lint or gauze. The 18¼ in. carton is outside the limit of the standard design, so modifications were necessary.

Another important difference from standard machines is that the cellulose film must not only be heat sealed over the carton but must also be glued to it. This is necessary because only the film is printed—the carton is plain. A gluing unit is provided on both machines.

The machine can produce progressively formed folds on the ends of a package, the last fold being turned up or under as required. Alternatively, when dealing with articles such as regular shaped cartons or trays, the machine may be arranged for double point end folding.

The articles to be wrapped are placed by hand in front of flights on an intermittent chain conveyor. Wrapped articles are discharged by an inclined flight conveyor which leads to a short roller conveyor located over the infeed.

The machine is easily adjusted for difference in package length by means of two handwheels. Variations in height and width are taken care of by a self-measuring paper feed—an important feature for the product pulls the paper or film, measuring exactly what it needs. This feature does not operate when using panel printed film. Control is then effected by a photo electric cell control mechanism. The speed is 30-35 wraps a minute.

▶SELF-CLEANING FILTER

The *Funda* filter, made by Mason and Morton Ltd., combines centrifugal force and pressure filtration to permit automatic cleaning. This increases production time by reducing cleaning and pre-coating.

The filter may be used as a pre-coat filter for polishing and clarification for pharmaceuticals, antibiotics, food and oil processing and the chemical industries generally. It can be used equally well for the recovery of dry residue as well as the filtrate, *e.g.* dyestuffs, yeast, etc.

The periodic opening of the filtration vessel and associated manual operation between filter sequences are avoided because the entire cleaning process is carried out within the filter itself. This method of cleaning allows the filter elements to be used to maximum capacity, for apart from a few minutes when pre-coating and cleaning takes place, the filter is in continuous operation.

The filter unit consists of a series of circular filter elements mounted on a hollow vertical shaft which can be rotated by a directly coupled motor. The unit is contained within a vessel which can be hermetically sealed. Slurry passes to the pressure vessel from the filter elements and down the hollow vertical shaft. The pre-coat and/or solid residue builds up on the upper face of the filter elements. Cleaning is effected by rotating the filter elements, the residue being thrown from the elements by centrifugal force. At the same time the stream of wash water or solvent is directed through the shaft and elements in the reverse direction to the normal flow. In the dry residue version a series of gas or air nozzles assist discharge.

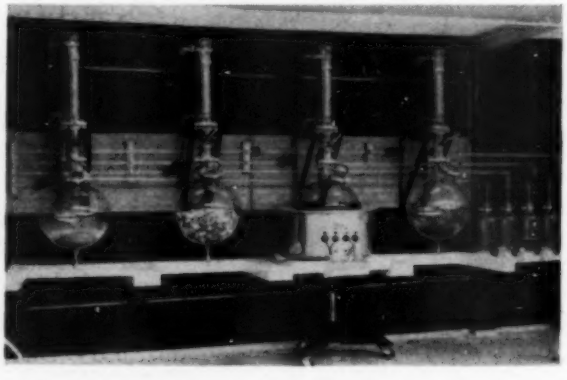
The complete process of pre-coating, filtration and cleaning can be arranged for automatic operation.

The filter is particularly useful for toxic substances.

▶HEATING MANTLE ADAPTATION

A unique use of one of the Electrothermal *M* series heating mantles has been devised by Coeberghs Distilleerderij N.V. Schiedam, in co-operation with Pieterman N.V., Electrothermal's agent in Holland.

In order to provide the heating required to produce various liqueurs, a travelling lifting platform was designed to transfer the heating mantle to the correct flask as and when required. This set-up provides an economical heating unit that is easily controlled by the use of an Electrothermal 4-circuit control box.



Electrothermal heating mantle on a specially constructed travelling lifting platform provides an economical heating unit.

Book Reviews

A Dictionary of Named Effects and Laws

In Chemistry, Physics and Mathematics. By D. W. G. Ballentyne and L. F. Q. Walker. Chapman and Hall, London. 1961. Pp. 234. 30*s. net.*

THE increasing specialisation of science has multiplied and complicated scientific terminology. This book has the laudable purpose of helping specialists in one field understand the vocabulary of others. It is designed as a quick-reference dictionary, not a textbook. Thus it is not classified by subject matter but presented strictly alphabetically. It is intended to eliminate time-wasting searches and to enable the reader to grasp the meaning of a strange term quickly so that he can get on with his reading. The success of the idea is proved by the appearance of a second edition within three years of the first. In this edition over 150 new definitions have been added, the appendix on "units" has been rewritten and mistakes and omissions have been rectified. This is an excellent guide to scientific terminology —from Abbe's Sine Condition to the Zener Effect.

Gas Chromatography 1960

Edited by R. P. W. Scott, Butterworth. Pp. 466. 95*s. net.*

THIS book contains the collected papers presented at the Third International Symposium on gas chromatography held in Edinburgh in mid-1960. Comparison with the 1958 symposium shows the increased scope of this latest symposium and the developments in the intervening two years.

The programme was divided into three sections: apparatus and technique; theory and application; and general applications. Attention was focused on the standard argon and flame ionisation detectors, both of which are extremely sensitive and capable of working over a wide linear range. It was suggested that the argon detector has a greater flexibility, but is disturbed by a number of things, particularly water vapour.

Several papers gave particular emphasis to capillary or tubular columns, which are specially suitable for high-resolution, low-temperature use and for fast analysis. It was predicted that gas chromatography for very fast analysis would have an extremely important application to process control—a subject that unfortunately received little attention during the symposium.

The use of gas chromatography for large-scale or preparative work was discussed by Mr. F. H. Huyten and others and some of the difficulties were stressed, particularly those of packing columns. The problem of identifying material leaving the columns produced a number of interesting contributions to the discussion.

Although one would have liked to see more time given to industrial applications, particularly process control, the publication of the proceedings of this symposium should be of great value to analytical chemists.

Detergents Glossary

By G. Carrière. Elsevier, Amsterdam and London. Pp. 141. 21*s. net.*

A FEW years ago the author was chief chemist at Lever's Zeep Maatschappij, Vlaardingen. In this capacity he attended various international congresses, and it struck him that there was frequent confusion of thought because the participants did not understand each other's technical terms. In 1957 he started making a list, for his own use, of technical terms used in the soap industry, and he had this list checked by colleagues in the Netherlands and abroad. The great interest shown in this induced Dr. Carrière to compile the present book. It is published in the Elsevier series "Glossaria Interpretum." This series comprises practical multilingual glossaries bearing on specifically defined branches of industry.

The Detergents Glossary defines terms used in the detergents industry in 19 languages, namely English, Dutch, Czech, French, Swedish, Hungarian, Spanish, Danish, Rumanian, Italian, Norwegian, Greek, Portuguese, Russian, Turkish, German, Polish, Japanese and Finnish. The first ten chapters list terms in groups of subjects such as washing agents, textiles, skin, soil, water, washing process, evaluation of detergency, foaming and bleaching. In each case the English term is given first followed by the equivalents in the 19 languages covered. The second part of the book gives the vocabularies by language and thus comprises an index to the terms defined.

There appears to be much interest in Dr. Carrière's work in many countries. During a conference of the Deutsche Gemeinschaft für Fettforschung, recently held at Hamburg, the book was distributed to the participants. In other countries the work is also greatly appreciated, especially in connection with the foundation of the Comité International de la Détergence where, in view of the many international contacts, the need is felt for precise terminology.

Directory of Opportunities for School Leavers

Cornmarket Press, London, 1961. *Pp.* 288. 5*s. and* 8*s.* 6*d. net.*

THE NUMBER of chemical firms giving their recruitment requirements in the 1961 Directory is nearly double the number listed in 1960. The total number of entries in the Directory has increased by 32% from 165 to 218 and of these 19 are chemical companies. Other increases are under the headings of electronics (13 to 23), mechanical engineering (31 to 54), electrical engineering (21 to 32) and chemical and civil engineering (both from 4 to 9).

These industries are all among those which are leading Britain's export trade. They are taking advantage of the "bulge" which means that many more intelligent school-leavers are available for recruitment. In all public, grammar and secondary modern schools throughout the country information about these firms will be read by those leaving school this summer and their teachers.

The editorial section is both valuable to the school leaver and easy to read. *Going to University* provides for the mystified would-be undergraduate, and for his parents, a concise guide through the intricacies of university entrance requirements. The professions are covered in an authoritative article; *Technical Training and Apprenticeship* are both dealt with and there is an article on the *Opportunities for Girls in Industry.*

The reference section sets out in detail information about commercial and industrial organisations and government departments. The classified index summarises in tabular form further information about the size of the organisations, whether boys or girls are employed, and the areas in which employment is offered. This year a new index has been added which gives details of training schemes offered by each company.

Aids to Forensic Pharmacy

By H. W. Fowler. 5th Edit. Baillière, Tindall and Cox. 307 *pp.* 12*s.* 6*d. net.*

THIS work, since the first edition in 1936, has mainly been for students entering the Pharmaceutical Society's qualifying examination, but it is also useful as a reference guide for practising pharmacists. It has also been extended to include material of use to veterinary students.

The effect of legislation on the pharmaceutical profession has been kept in mind throughout this edition. It has been divided into two parts: Part I deals with the law and its immediate effects, with explanations where possible, on the principle that the requirements are more readily understood and remembered if the reasons are known. Part II is an innovation, and consists of a summary of the procedures used in various circumstances, with specimens of documents, records, labels, etc., to aid those without previous experience and for reference when the procedures are first encountered in practice.

United States Dispensatory

Vol. 2. New Drug Developments. J. B. Lippincott Co. Pp. 240. 72*s. net.*

IN RECENT years, between 40 and 50 new medicinal agents, exclusive of their many dosage forms, have been introduced annually. Thus, since the last edition of the Dispensatory was published nearly five years ago, somewhat more than 200 new drugs have come into use. This volume serves three purposes; it provides information about these new therapeutic substances, it gives new information about drugs described in the main volumes, and it provides general survey articles on certain categories of medicinals, *e.g.* antibiotics with anti-tumour activity, hypoglycæmic sulphonylureas and biguanides, psychotherapeutic and psychotomimetic drugs, and saluretic agents.

WRITING A BOOK?

The publishers of MANUFACTURING CHEMIST invite the submission of manuscripts of books to be considered for publication. All manuscripts will be promptly acknowledged and carefully considered by qualified experts. A synopsis with chapter headings should be sent in the first instance to The Manager, Leonard Hill (Books) Ltd., Leonard Hill House, Eden Street, London, N.W.1. Leonard Hill are specialists in industrial, technical and scientific books. They have a reputation for vigorous and successful promotion of their books by extensive advertising and maintain a world wide selling and distributing organisation.

Since there has been an increasing demand from most users of the Dispensatory for information about actions, uses, doses and the side effects of drugs, greater emphasis has been placed on supplying pharmacological and clinical data and less on standards and tests. The work throughout is carefully referenced—more than 400 journals were reviewed during the past five years for this information.

Fuel Research 1917-1958

D.S.I.R. H.M. Stationery Office. Pp. 120. 15*s. net.*

THE purpose of this book is to draw attention to the vast mass of information contained in the hundreds of reports and scientific papers issued from the now defunct Fuel Research Station during the 40 years of its existence, and to make the information easily accessible to future workers.

Besides a considerable amount of work on combustion and steam raising, the part of this book of interest to the chemical industry is the section dealing with the production of oils and chemicals from coal. Various experiments on the hydrogenation of coal and tar are described as well as the catalytic synthesis of hydrocarbons by the Fischer-Tropsch process. Different catalysts were studied including cobalt and iron types. Other sections deal with the synthesis of lubricating oils and the thermal decomposition of paraffin hydrocarbons.

Breakaway Unions and the Small Trade Union

By Shirley W. Lerner. George Allen and Unwin Ltd. Pp. 210. 25*s. net.*

THIS book's title may not at first glance qualify it for review in these columns, but its interest for us lies in the fact that one of the case studies deals with the Chemical Workers Union. This is used to demonstrate the difficult relationship of the small union with the more powerful union.

The organisation of trade unions among chemical workers started in the heavy chemical sector of the industry in the north, about 1889, and was part of the growth of the many small local labourers' unions formed at that time. The drug and fine chemical industry, mainly concentrated in London and the Home Counties, became organised later with the agitation for industrial unionism. The author traces the history and development from these early days of the Chemical Workers' Union which was affected by competition with the large general workers' unions.

Size is not the only factor which distinguishes this union from its competitors. The CWU is an industrial union; although it does not recruit maintenance workers and therefore does not compete with craft unions, it does recruit process, office, distributive and professional workers in the chemical industry. On the other hand, its competitors are general workers' unions whose jurisdiction covers many different industries.

The author points out that general unions sometimes assert that the CWU is really a general union because it recruits workers who produce rayon, atomic energy, and non-ferrous metals. The CWU, however, includes these sectors in its definition of the chemical industry.

The facts that this book provides are astonishing when one considers the size of the chemical industry. The CWU has only 20,000 members —I.C.I. alone employs over five times this number.

It is apparent from this that the Union is as far away as ever it was from establishing one union for all chemical workers. With the present inter-union bickering, the author suggests that the practical solution would be a Federation of Chemical Workers combining a working group of unions or sections of unions concerned with the chemical industry.

Price cutting will raise N.H.S. costs—pharmacists warn M.P.s

Eleven thousand pharmaceutical chemists have sent a statement through their trade organisation, The Proprietary Articles Trade Association, to every M.P. giving a warning of the consequences of costs and standards of service to the National Health Service if individual resale price maintenance is abolished.

In the statement, "Resale Price Maintenance—The Pharmacy Aspect," they point out that their two main professional functions—the dispensing of prescriptions and the authorised selling of poisons—represent the smallest section of turnover. If they had to rely solely on the proceeds from these services they would have to charge more for them and the cost to the Health Service and to private patients would be correspondingly higher.

The statement emphasises that it is only the guaranteed margin on the proprietary articles he sells which enables the chemist to earn a reasonable livelihood without throwing an undue financial burden on the dispensing side of his business and blunting his professional concentration by plunging him into the chaos and anxieties of a price-cutting war.

Attention is also drawn to the fact that competition between individual manufacturers of branded products of a similar type, *e.g.* proprietary medicines, toothpastes, cosmetics, is intense: there is no agreement between the different manufacturers as to the retail prices to be charged for their goods. These factors are, in themselves, a guarantee of minimum prices.

The statement adds that three Government enquiries, the Women's Organisations and the Trade Union movement have all confirmed that individual price maintenance is in the public interest. It is therefore felt that any new or amending legislation would be unjustified and unnecessary since there is already machinery within the Restrictive Trade Practices Act, 1956, to deal with any abuses or evasions of the provisions applicable to certain kinds of price-fixing.

The statement concludes: "The present system of individual resale price maintenance ensures that the public can obtain proprietary goods all over the British Isles at the lowest economic cost, and on terms equitable to the producer and distributor."

Record chemical exports

The chemical industry achieved a record in exports in 1960, amounting to £316 million, an increase of £23 million on 1959. This represents 10·5% by value of all U.K. manufactured exports.

The Exports Committee of the Association of British Chemical Manufacturers has been active for some years in promoting increased exports and, as part of this drive, recently held the first of two export promotion conferences, which was opened by an address from Mr. F. J. Erroll, M.P., Minister of State, Board of Trade.

Congratulating the Association on its export record, Mr. Erroll said that the problem of increasing exports was not new, but an increase in exports was essential to balance our overseas trade. He referred to an interesting development—the growth of trade in manufactured goods between industrial countries. Industrialised countries appeared to be the fastest growing markets for chemicals, because of the increase in industrial activity and also because chemical industries tended to "take in each others' washing."

The Conference, which was attended by some 160 delegates, was intended to encourage small or non-exporters to play their part in improving the performance of the industry. Papers read by members of the Association's Exports Committee gave advice in developing overseas markets. An agent of a member firm spoke of his experiences in selling U.K. chemicals in the Common Market—an area in which the future demand was likely to expand greatly and from which the United Kingdom might be excluded if Europe continued to be divided into two trading areas.

Squibb build research lab.

Construction of the new research laboratory of E. R. Squibb and Sons in Speke, Liverpool, commenced in February. The work to be carried out in the new laboratories will contribute to the co-ordinated research activities of Squibb. The main research centre, the Squibb Institute for Medical Research, is an extensive installation in New Brunswick, U.S.A., where more than 600 qualified people are engaged in the discovery and testing of new drugs.

Squibb have already extended their overseas research facilities to Mexico, Brazil and Argentina.

I.C.I.'s £100m. Common Market project

I.C.I. plans to build a complex of petroleum chemicals plants in Holland to give it a manufacturing base in the Common Market. Western Europe has always been an important market for I.C.I. and the new plans illustrate the company's determination to keep and expand its business there. A 300-acre site in Rotterdam is being negotiated and the company is willing to spend up to £100 million on it in the next ten years. Other manufacturing units within the Common Market are envisaged.

The project will be supervised by a board under the chairmanship of Mr. D. M. Bell.

Drug exports a record

Exports of British drugs and medicines reached a record figure of over £44 million in 1960, an increase of £3·4 million over 1959. Well over one-quarter of the pharmaceutical industry's production is exported.

Figures published by the Board of Trade show that Australia (£4m.), Nigeria (£2·8m.), Pakistan (£2·4m.), the Irish Republic (£2m.) and New Zealand (£2m.) were the five leading importers, followed by Canada, South Africa and the United States (each £1·5m.), Ghana (£1·4m.), India (£1·3m.) and Burma (£1m.). Exports to the Common Market countries (excluding Luxembourg) were £3·4m. as compared with £2·7m. in 1959.

Over half the export trade is accounted for by miscellaneous proprietary medicines (£12·8m.), antibiotics (£8·6m.) and vitamins (£2·7m.). Sales of over £1m. were recorded for alkaloids, antimalarial drugs, aspirin, sulphonamides and hormones; and of over £500,000 for anti-histaminics, barbiturates and insulin.

Recent takeovers

The offer made by Glaxo for Evans Medical Ltd. has now been accepted by stockholders of the latter company holding over 90% of both ordinary and preference shares. This share deal follows close on the acceptance of takeover bids by the boards of two other companies. Howards have accepted the offer made by Laporte and Bush have accepted that made by the Albright and Wilson group.

Prescription charge doubled

On March 1 the new prescription charge of 2s. was introduced. This is double the former charge. Henceforth 2s. will be payable for each drug or appliance, other than elastic hosiery.

TV discussion on drug profits

The South West Metropolitan Regional Hospital Board has saved some £150,000 by buying drugs from abroad. This was stated on BBC television by Mr. E. A. Cross, chairman of the pharmaceutical advisory committee of the Board. He took part in a discussion on drug profits with Dr. D. E. Wheeler, vice-president of the A.B.P.I. (and managing director of Burroughs Wellcome), and Mr. Elmer Browne, managing director of Merck Sharp and Dohme Ltd.

At the beginning of the programme it was stated that last year the Ministry of Health paid £100 million for drugs of which £67 million went to drug manufacturers, of which there are some 300 in this country. The 16 American firms operating here made a profit on the year of about 70%, the British companies about 20% and the Swiss about 13%.

Dr. Wheeler said it might be possible to buy drugs more cheaply on the Continent, particularly if these drugs are original inventions made in this country. Research and development costs had to be recovered by British firms. Discussing promotional literature, Dr. Wheeler said its purpose was to inform doctors of new developments in a fast changing field. His company had offered samples of a new drug to doctors and over 30% replied asking for the samples.

Mr. Browne was asked to comment on the 70% profits made by U.S. firms in Britain. He said that it was unfair to take just one year; the trend over several years should be taken. Mr. Cross asked Mr. Browne why the cost of research was apparently still included in the price of antibiotics "which hasn't changed in ten years." Mr. Browne replied that the high cost of research to find new drugs had to be paid for from the return on the winners. There was a high rate of attrition; out of 2,830 substances investigated by American companies in a certain period only one survived.

Dr. Wheeler's reminder that the British drug industry was spending £6·25 million a year on research caused Mr. Cross to ask how much was spent on advertising. "My company," replied Dr. Wheeler, "spends 1½% of our turnover on advertising to doctors."

The discussion ended with the interviewer saying that the cost of drugs in the Health Service as a whole has not altered greatly in the last ten years.

New drugs and formulations

A total of 160 new prescription products were marketed in 1960 by 78 pharmaceutical firms. Of these, 56 were for single new drugs. The following table gives the categories of these drugs:

Category	*Number of products*
Tranquillisers and sedatives	9
Chemotherapeutic agents	8
Diuretics	4
Antihistaminics	3
Anti-Parkinsonism drugs	3
Antitussives	3
Uricosuric agents	3
Analgesics	2
Angina pectoris treatment	2
Miscellaneous	19
Total	56

The miscellaneous group comprises 19 categories with only one drug each; their uses include: cytotoxic agent, anthelmintic, trichomonicide, anabolic agent, anticonvulsant.

Twelve products are modifications of forms of therapy already known, *e.g.* a co-dried gel of aluminium hydroxide-magnesium carbonate.

Sixteen products contain a single drug already available, either in another form or from another manufacturer, *e.g.* sodium edetate, paracetamol.

Seventy-six new products are formulations marketed by 48 different firms, ranging from one to four formulations per firm. Six of these formulations contain compounds not previously marketed in this country.

These figures are based on information supplied by the Index of New Products (The Pharmaceutical Press, 17 Bloomsbury Sq., London, W.C.1).

Rayophane sales

British Rayophane Ltd. have ended the contract with their sole agents Felber, Jucker and Co. Ltd. All *Rayophane* sales operations are now being conducted by the sales organisation of British Rayophane Ltd., which will consist very largely of the same people who have hitherto done the work. The London selling organisation will be centred at 11 New Fetter Lane, E.C.4, and the Northern sales organisation at Sunlight House, Quay Street, Manchester 3.

All outstanding payments and payments which thereafter become due should be made to the accountant, British Rayophane Ltd. (P.O. Box No. 484), Sunlight House, Quay Street, Manchester 3. To this office should also be addressed all enquiries.

Complan for the Congo

Glaxo Laboratories are flying gift supplies of *Complan*, a complete food, to help starving Baluba refugees in the Congo. Supplies are going to a hospital at Bakwanga, reported to be handling four times as many patients as normally.

Additives and contaminants in food

The Government's Food Standards Committee has appointed a Food Additives and Contaminants Sub-Committee to replace the Preservatives Sub-Committee, which has now completed the work for which it was set up in 1951. It will consider problems referred to it by the Food Standards Committee in relation to all substances added to food, whether deliberately or not. The chairman of the new Sub-Committee is Sir Charles Dodds, F.R.S.

The Preservatives Sub-Committee was set up in 1951 to review the Public Health (Preservatives, etc., in Food) Regulations. Because of the wide range of substances to be covered the Sub-Committee considered and issued reports separately on antioxidants (1953 and 1954); colouring matters (1954 and 1955); emulsifying and stabilising agents (1956); and, finally, preservatives (1959).

Check on food solvents and flavours

The Food Additives and Contaminants Sub-Committee of the Food Standards Committee are to undertake a review of solvents and flavouring agents.

The sub-committee want the co-operation of the trade, enforcing authorities and other interested bodies. In particular, they wish to obtain information as to the solvents and flavouring agents, both natural and synthetic, at present in use; their chemical composition and properties; the foods to which they are added or applied; the amount used and mode of use; and evidence as to the absence of any deleterious effect resulting from their use. Similar information is required about any new substances being developed and any advantages which these may have over solvents and flavouring agents in current use.

The sub-committee would also welcome evidence of the need for control in this field and of any deleterious effects resulting from the use of solvents and flavouring agents whether used at present in this country or not.

Interested organisations should write to the Joint Secretary, Food Standards Committee, Great Westminster House, Horseferry Road, London, S.W.1, to reach him not later than May 8, 1961.

Abbott's new factory

The new Abbott Laboratories factory which is being built on a 130-acre site at Sheerness, Kent, will be one of the largest ethical pharmaceutical plants in the country. It is due to be handed over to the owners on October 23.

New Colgate-Palmolive factory

Colgate-Palmolive Ltd. are planning to build factory premises on a site at Moorgate Road, Kirkby, Liverpool.

New store buildings for Laporte Acids

Two new precast concrete buildings have just been completed for Laporte Acids Ltd. by E. W. Tyler and Co. Ltd. The company is now a principal supplier of sulphuric and hydrochloric acid, Glauber's salt, iron sulphide and sodium hyposulphite to the Leeds industrial area.

The new buildings follow an earlier Tyler structure erected in 1958. The new drum store is 90 ft. × 50 ft. and 13 ft. to the eaves with a smaller building 16 ft. 6 in. wide coupled to it. Roof sheeting is in natural Corroplast.

The second new building, a further storage shed, is 75 ft. × 50 ft. × 16 ft. to the eaves. Vertical corrugated asbestos sheeting has been fitted 11 ft. down from the eaves, across one 50 ft. end and one 75 ft. side.

Papers invited for Pharmaceutical Conference

This year the British Pharmaceutical Conference meets at Portsmouth from September 18 to 22. The usual Science Sessions will be held for the presentation of papers dealing with original work on subjects of pharmaceutical interest, and workers in these fields are invited to submit contributions. These may be either full papers (up to 4,000 words) or short communications (not more than 1,000 words). The latter may take the form of (*a*) an advance report of an investigation which it is intended to publish in full at a later date; (*b*) an interim report of an investigation which is not yet complete; or (*c*) a résumé of an investigation which does not justify a full paper.

Completed manuscripts should be submitted to the Honorary General Secretaries at 17 Bloomsbury Square, London, W.C.1, as soon as possible, but in any case all manuscripts must be received not later than May 23. Three copies (including diagrams, figures and tables) are required.

Franco-British Pharmaceutical Congress

About 75 British and 75 French pharmacists are to meet this year in Jersey for the Ninth Franco-British Pharmaceutical Congress. The subject for discussion at the session on the Saturday is to be "The Future of the Chemist's Shop." Mr. Allen Aldington, member of the Society's Council, is to be the British rapporteur.

The British party will fly from Gatwick at midday on Friday, May 12, and return about the same time on the Monday morning. The cost of the complete week-end (including all travel, hotel, excursion and other expenses) will be £20 per person. Requests for application forms should be made at once to the Secretary, Franco-British Pharmaceutical Commission, 17 Bloomsbury Square, London, W.C.1.

A.B.P.I. guidance on price regulation scheme

The Association of British Pharmaceutical Industry has reminded its members that the modified Voluntary Price Regulation Scheme, upon which agreement was reached recently with the Minister of Health, will run until June 30, 1964. It retains the same general framework as before: after an initial three-year period of freedom from control the maximum price for each product is fixed by reference to export prices where exports are substantial; otherwise by reference to the price of an exact unbranded equivalent, where this exists, or under a constructed formula.

The following explanations of the main modifications to the scheme have been issued by the A.B.P.I.:

Three-year freedom period

During the first three years from the date on which a preparation is first made available on E.C.10 prescription its price is not subject to the scheme.

In future this will not apply to a preparation of which all the active ingredients have been official (*i.e.* B.P. or B.P.C.) for five years or more, except where it can be shown that appreciable research or development work has contributed to its evolution.

Export criterion

Where a firm's total exports of products subject to the scheme amount to at least 25% of total production a single preparation will continue to qualify at 20%. Otherwise the percentage of sales that must be exported before the export price criterion can be used for a particular product is increased from 20 to 25%.

Constructed formula

The formula which fixes the maximum price for products which do not satisfy the export criterion and for which there are no exact unbranded equivalents is revised so as to result in lower maxima.

Direct negotiations

The Health Departments may call for direct negotiations in respect of any preparation which qualifies for the export criterion but is a preparation of a patented drug of which total sales to meet prescriptions on Form E.C.10 in respect of all brands and dosage forms together amounted, during the last twelve months for which information is available to £500,000 wholesale.

As in the original scheme the industry have undertaken that prices will not, save exceptionally, be increased where they are below the maxima indicated by the formulæ.

Instrument conference

The Society of Instrument Technology and the Birmingham Productivity Association are holding a conference at Birmingham College of Technology, Gosta Green, Birmingham, on March 29.

This conference is aimed at the small- to medium-sized manufacturer, and the object is to show the various aspects of instrumentation which will increase productivity profitably.

To introduce the managements of the manufacturers to instruments, an instrument exhibition has been arranged with the conference, at which instruments which are discussed during the day are exhibited.

Third Annual Survey of Pharmaceutical Industry Expansion

We are now collecting information for our third annual survey of expansion in the British Pharmaceutical Industry. Questionnaires have been distributed and we wish to thank the many firms who have completed and returned them. The information is now being processed.

Firms who have not yet returned their questionnaires are asked to do so as quickly as possible. Further questionnaires may be obtained from: The Editor, MANUFACTURING CHEMIST, 9 Eden Street, London, N.W.1 (Tel.: Euston 5911).

Analysts' meeting

The annual general meeting of the Society for Analytical Chemistry was held on March 3 at Burlington House, London, W.1. The retiring president, Mr. R. C. Chirnside, gave an address on "The Enlargement of Horizons in Analytical Chemistry."

In the evening the Society held its biennial dinner at the Fishmongers' Hall, London Bridge.

Dunlop Chemicals expands

The sales force of Dunlop Chemical Products Division has been divided into two sections, one dealing with adhesives and compounds, the other with polymers.

The new sales system replaces the old system of sales control by areas, although supply depots are being retained in Glasgow, Salford and Wembley. New appointments are:

H. J. Northeast (formerly sales manager)—general sales manager; F. G. Delahoy (formerly assistant sales manager)—sales manager, adhesives and compounds; and J. D. Banks (formerly technical salesman, North)—sales manager polymers.

D. K. Fraser, joint managing director of G. A. Harvey and Co. (London) Ltd., has been appointed managing director. **H. E. Cooper** has relinquished his office of joint managing director but remains a director of the company.

Lord Netherthorpe has been appointed deputy chairman of Fisons Ltd. Lord Netherthorpe, formerly Sir James Turner, joined Fisons Ltd. on February 1, 1960. He was president of the National Farmers' Union for 15 years until the beginning of last year.

R. G. Allan has been appointed chief entomologist to the Pyrethrum Board of Kenya, which controls the production of Kenya pyrethrum. After taking his degree at Edinburgh University Mr. Allan was seconded to the Sudan Government for three years as a research entomologist and then spent a year as a graduate lecturer at the University of Florida. **D. Glynne Jones,** whom he succeeds as chief entomologist, is now concerned with the co-ordination of the activities of the Pyrethrum Technical Information Centre.

F. A. Lesser, the deputy chairman and managing director of Borax (Holdings) Ltd., has been appointed to the board of Hardman and Holden Ltd. This appointment follows the recent acquisition of Hardman and Holden Ltd. by the Borax Group.

Rolf H. Stein has been appointed a director of Victor Blagden and Co. Ltd. This company is a wholly owned subsidiary of Blagden and Noakes (Holdings) Ltd. and represents the chemical interests of the Group.

Leon Givaudan has been appointed a director of L. Givaudan and Cie S.A., Vernier, Geneva. For eight years he was in South America, where he directed Companhia Brasileira Givaudan, and also was responsible for the organisation and development of several associated companies.

Sir Miles Thomas, chairman of Monsanto Chemicals Ltd., has been appointed a director of P. Leiner and Sons Ltd., the world's largest ossein gelatine manufacturers.

I.F.F. (Great Britain) Ltd. have appointed **Bernard Maloney** as perfumery representative for the London and Home Counties area.

A new position, Senior Scientist, has been created by Monsanto Chemicals Ltd. for one of its technical staff, **Dr. I. S. Wilson.** This appointment is part of a Monsanto scheme under which outstanding scientists on the company's staff may receive proper recognition of their status while continuing to specialise in scientific or technical work rather than accepting increased administrative responsibility. In his new capacity Dr. Wilson will devote his whole time to research on effluent treatment and the micro-biological breakdown of organic compounds. He is a leading authority on effluent purification.

C. Hull

L. Givaudan

B. Maloney

Norman Heaton has been appointed company secretary to all companies within the Pfizer Group. He was secretary and sales manager of Kemball, Bishop and Co. Ltd., a member of the Pfizer Group.

Charles Hull has been appointed general manager, Stanlow refinery, Shell Refining Co. Ltd., in succession to **C. R. Middleton,** G.M., who retired after 35 years' service with the Royal Dutch/Shell group. Mr. Hull, who is 46, joined the Anglo-Saxon Petroleum Co. Ltd. in 1937. He once worked as a technologist at Stanlow refinery.

Dr. E. M. Vyner, F.R.I.C., M.I.CHEM.E., has been appointed director of research of the new company of Leiner-De Mulder Ltd. A graduate of Prague University, Dr. Vyner was concerned in the development of processes for Scheidemandel A.G. of Berlin. He then joined Sheppey Glue and Chemical Works Ltd., and during his 20 years' service with the company became director and works manager. The "Vyner Degreasing Process," is employed at Sheppey's Queenborough factory, another plant is working in Holland. Also recently he has designed a new British plant for the granulation of inorganic compound fertilisers. Leiner-De Mulder degrease animal bone and manufacture meat and bone meal and tallows.

Dr. Ronald Britton, head of the pharmaceutical division, has been appointed a director of Horlicks.

Mobil Chemical Co., a division of Mobil Oil, has retained **Dr. Gilbert B. Carpenter** as technical adviser. He will work at the offices of Mobil Oil Nederland N.V., Stadhuisplein 30, Rotterdam.

Viscount Boyd of Merton has been appointed sole managing director of Arthur Guinness Son and Co. following the retirement of Sir Hugh Beaver as joint managing director.

Formerly manager of the ethical drugs division of Aspro-Nicholas Ltd., **F. R. Crabbe** has joined Dow Agrochemicals Ltd., King's Lynn, Norfolk, as director of marketing. Mr. Crabbe, who is 40, was at one time sales manager of Vitamins Ltd.

Sir Robert Barlow retired from the chairmanship of the Metal Box Co. Ltd. and has been appointed honorary president. He has also retired from the chairmanship of the Metal Box Co. Overseas Ltd. He remains a director of both companies. **Sir Harold Roxbee Cox** has taken his place as chairman of the two companies and in consequence he has resigned from the board of Wilmot Breeden (Holdings) Ltd.

Dr. P. H. Sykes, director of research and development of the Reed Paper Group, has been appointed deputy managing director of Albert E. Reed and Co. Ltd. **Mr. Philip G. Walker** is managing director.

In order to take up his appointment with Reed in 1958, Dr. Sykes resigned his position as technical and research director of the British Oxygen group of companies. After graduating in New Zealand and London Dr. Sykes entered industrial life in 1935 with I.C.I.

D. E. Seymour, managing director of Smith and Nephew Research Ltd., has been appointed to the board of the parent company, Smith and Nephew Associated Companies Ltd.

After 51 years service **Alf Hardy** has retired from Stafford Allens, where he has been mills manager since 1936. He came to Stafford Allen in 1909 and worked in the general office as a clerk until 1914. After four years' war service he returned to work in the shipping office and in 1920 was transferred from there to the mill production office, where he was made assistant to the mills manager.

Mr. Hardy is spending his retirement in the country and is giving up his home in Palmers Green to pursue his hobbies of gardening, interior decorating and motoring.

Taking over from Mr. Hardy is another with a distinguished record of long service—**A. Rae**—who has been with the company for 34 years.

Alfred and Mrs. Hardy being greeted by the directors of Stafford Allens, R. K. Allen and A. W. Allen, at the dinner given in Mr. Hardy's honour. He has been with the company 51 years.

P. A. Gill has been appointed general manager of the Pfizer chemical sales division in the United Kingdom. Before this appointment he was concerned with the commercial aspects of Pfizer business in international markets.

John Villeneuve, previously Kemball Bishop technical service manager, has been appointed sales manager responsible to Mr. Gill for both chemical sales and technical service.

A. Elliot, export manager of Baird and Tatlock (London) Ltd., with whom he has served for 23 years, has been appointed general sales manager of the associated company, W. B. Nicolson (Scientific Instruments) Ltd.

J. H. Sellars, has been appointed works manager (services) of United Coke and Chemicals Co. Ltd. **R. C. Limb,** who rejoined the company some months ago as assistant work study officer, will take his place as work study manager.

P. W. Seligman has been appointed deputy chairman of the A.P.V. Co. Ltd. while retaining his present position of managing director. **H. P. N. Benson** has also been appointed a managing director.

W. H. Reay has been appointed general manager of Luwa (UK) Ltd., a recently formed British subsidiary of Luwa A.G., Zurich, Switzerland. He joined the Luwa organisation in July 1960.

Adrian C. Furse-Roberts, treasurer and secretary and **Samuel W. McCune,** general sales manager, have been elected directors of the Du Pont Co. (United Kingdom) Ltd. William H. McCoy, managing director of the Du Pont British subsidiary, said: "We are particularly pleased to see Mr. Furse-Roberts, a British member of our staff, elected to this important position. This is in line with our policy to have an ever-increasing number of British personnel in responsible positions."

Richard Pfizenmaier has resigned as managing director of Smith Kline and French Laboratories Ltd., but will continue as vice-chairman with responsibility for the Group activities, with particular emphasis on exports. **Stanley Fenwick** becomes managing director of the British company, responsible for operations in the U.K. and Ireland. **Frank Hodson,** lately director in charge of medical promotion, becomes director of the newly constituted marketing division, covering ethical medical, veterinary and publicly advertised products. **Ronald Clark,** previously responsible for direct exports from the U.K., takes charge of a new industry relations department. **Dr. Gordon Hargreaves,** previously of the Smith Kline and French Research Institute, will head a new overseas market development department.

Following the acquisition of the Crookes Laboratories Ltd. by Arthur Guinness Son and Co. Ltd. and Philips Electrical Industries Ltd., the following appointments have been made to the board of Crookes: **N. B. Smiley** (chairman); **Trevor Jackson** and **Dr. C. J. Virden.**

Mr. Smiley is joint managing director of Arthur Guinness Son and Co. (Park Royal) Ltd., and Dr. Virden is an assistant managing director of that company. Mr. Jackson has been nominated by Philips.

G. E. Watson, M.B.E., remains on the board of Crookes Laboratories with **J. R. Bowden** and **C. J. Clarke.** Mr. Watson will continue to be general manager.

A. J. C. Hoskyns-Abrahall has been appointed to the board of Unilever Ltd. He is also to be proposed for election to the board of Unilever N.V. He joined Unilever as a management trainee in 1928 and held a number of marketing posts in associated companies. After the war he became marketing director, and a few years later chairman, of the associated companies in India, and when those companies were amalgamated into Hindustan Lever Ltd. in 1956 he became its first chairman. He was president of the Bombay Chamber of Commerce and Industry in 1956/7. He returned to this country in 1957 and joined the margarine group as chairman of its two marketing companies and vice-chairman of Van den Berghs and Jurgens Ltd., becoming chairman of the group and of the last named company in 1958.

Anthony P. Podesta has been appointed to the main board of Miles Laboratories Ltd., Stoke Poges, Bucks. He will head operations in the Common Market.

Mr. Podesta previously served Miles from 1954 to 1959 in various capacities concerned with overseas interests. For a short while he was with the Beecham Group in Canada and with Harold F. Ritchie and Co. Ltd. He rejoined Miles in December 1960.

S. P. Chambers chairman of I.C.I., has been visiting India and Pakistan. It was the first visit he has paid as chairman to offices and factories of the I.C.I. subsidiaries, I.C.I. (India) Private Ltd. and I.C.I. (Pakistan) Ltd.

Mr. Chambers is no stranger to India, having acted for some years before the war as Taxation Adviser to the Government of India, during which time he became a member of the Indian Legislative Assembly and later of the Council of State. He was created a Companion of the Indian Empire for his services.

New List of Approved Names for Drugs

The General Medical Council has issued a further list of approved names for drugs selected or devised by the British Pharmacopœia Commission. All enquiries should be sent to the General Medical Council Office, 44 Hallam Street, London, W.1. Here is the latest list:

Approved name — *Other names*

AMPHOMYCIN
An antibiotic produced by *Streptomyces canus*

BETAMETHASONE
9α - Fluoro - 11β : 17α : 21 - trihydroxy-16β - methylpregna - 1 : 4 - diene-3 : 20 - dione
9α - Fluoro - 16β - methylprednisolone

BIPERIDEN
1 - (*bicyclo*[2 : 2 : 1]Hept - 5 - en - 2 - yl)-1 - phenyl - 3 - piperidinopropan - 1 - ol
The name Akineton is applied to the hydrochloride and the lactate

CHLORDANTOIN
5 - (1 - Ethylpentyl) - 3 - (trichloromethylthio)-hydantoin

CHLORDIAZEPOXIDE
7 - Chloro - 2 - methylamino - 5 - phenyl-3H - benzo - 1 : 4 - diazapine 4 - oxide
Librium is the hydrochloride

CHLORPROTHIXENE
α - 2 - Chloro - 9 - (3 - dimethylaminopropylidene)-thiaxanthen
Taractan

CHLORTHALIDONE
3 - (4 - Chloro - 3 - sulphamoylphenyl) - 3 - hydroxy-*iso*indolin-1-one
Hygroton

*CLONITAZENE
2 - *p* - Chlorobenzyl - 1 - (2 - diethylaminoethyl(-5-nitrobenzimidazole

DEMECARIUM BROMIDE
Decamethylenebis(*m* - dimethylaminophenyl - *N* - methylcarbamate) dimethobromide
Humorsol

DIOXAMATE
4 - Carbamoyloxymethyl - 2 - methyl - 2 - nonyl-1 : 3-dioxolan

ECTYLUREA
α-Ethylcrotonylurea
Nostyn

ETHCHLORVYNOL
5 - Chloro - 3 - ethylpent - 1 - en - 4 - yn - 3-ol
Placidyl

ETHOSUXIMIDE
α-Ethyl-α-methylsuccinimide
Zarontin

*ETONITAZENE
2 - *p* - Ethoxybenzyl - 1 - (2 - diethylaminoethyl)-5-nitrobenzimidazole

HEXAPROPYMATE
1-Propynyl*cyclo*hexyl carbamate
Merinax

HYDROMORPHINOL
14-Hydroxydihydromorphine

ISOAMINILE
4 - Dimethylamino - 2 - *iso*propyl - 2-phenyl-valeronitrile
Dimyril is the citrate

ISOXSUPRINE
1 - *p* - Hydroxyphenyl - 2 - (1 - methyl - 2-phenoxyethyl-amino)-1-propanol
Dilavase is the hydrochloride

METHICILLIN
6 - (2 : 6 - Dimethoxybenzamido)penicillanic acid
Celbenin is the sodium salt; Staphcillin is the sodium salt

OXYMETHOLONE
2 - Hydroxymethylene - 17α - methyldihydrotestosterone
Anapolon

PEMOLINE
2 - Imino - 5 - phenyloxazolidin - 4 - one
Kethamed; Pioxol

D-PENICILLAMINE
(−)-ββ-Dimethylcysteine

PHENBUTRAZATE
2 - (3 - Methyl - 2 - phenylmorpholino) ethyl α-phenylbutyrate

PHENDIMETRAZINE
(+)-3 : 4-Dimethyl-2-phenylmorpholine
Plegine is the tartrate

*PHENOPERIDINE
Ethyl 1-(3-hydroxy-3-phenylpropyl-4-phenylpiperidine-4-carboxylate

PIPAZETHATE
2-(2-Piperidinoethoxy)ethyl 10-thia-1 : 9-diazaanthracene-9-carboxylate
Selvigon is the hydrochloride

PLASMINOGEN
The specific substance derived from human plasma which, when activated, has the property of lysing fibrin

PYRAZINAMIDE
Pyrazinoic acid amide

SODIUM IRONEDETATE
Iron chelate of the monosodium salt of ethylenedaimine - *N.N'N'* - tetra-acetic acid
Sytron

STREPTODORNASE
An enzyme obtained from cultures of various strains of *Streptococcus haemolyticus* and capable of catalysing the depolymerisation of polymerised deoxyribonucleoproteins

STREPTOKINASE
A co-enzyme obtained from cultures of various strains of *Streptococcus hæmolyticus* and capable of changing plasminogen into plasmin

TRANYLCYPROMINE
(+)*trans*-2-Phenyl*cyclo*propylamine
Parnate is the sulphate

* Narcotic substances which fall under International Control and are not available as therapeutic agents.

INDEX

Proprietary Name		*Approved Name*
Akineton	.. ..	Biperiden
Anapolon	.. ..	Oxymetholone
Celbenin	.. ..	Methicillin
Dilavase	.. ..	Isoxsuprine
Dimyril	.. ..	Isoaminile
Humorsol	.. ..	Demecarium Bromide
Hygroton	.. ..	Chlorthalidone
Kethamed	.. ..	Pemoline
Librium	.. ..	Chlordiazepoxide
Merinax	.. ..	Hexapropymate
Nostyn	.. ..	Ectylurea
Parnate	.. ..	Tranylcypromine
Pioxol	.. ..	Pemoline
Placidyl	.. ..	Ethchlorvynol
Plegine	.. ..	Phendimetrazine
Selvigon	.. ..	Pipazethate
Staphcillin	.. ..	Methicillin
Sytron	.. ..	Sodium Ironedetate
Taractan	.. ..	Chlorprothixene
Zarontin	.. ..	Ethosuximide

G. A. Harvey move

The sales department of G. A. Harvey and Co. (London) Ltd. has moved from Greenwich and now operates from Villiers House, Strand, London, W.C.2. The publicity department remains at Greenwich.

B.P.C. amendments

The Council of the Pharmaceutical Society of Great Britain has authorised the publication of the following amendments and corrigenda to the British Pharmaceutical Codex 1959.

AMENDMENTS

p. 14 **Acriflavine**
Content of total acridines. Amend to: Not less than 98·5 and not more than the equivalent of 105·0%, calculated as $C_{14}H_{14}N_6Cl,HCl$, with reference to the anhydrous substance.

p. 237 **Dextromethorphan Hydrobromide**
Action and Uses. Amend the last sentence to: It is administered in tablets containing 15 milligrams or as a solution containing 10 milligrams per 5 millilitres.

p. 359 **Hyoscine Hydrobromide**
Sterilisation. Amend the first sentence to: Solutions for injection are sterilised by heating in an autoclave, or by filtration.

p. 1140 **Tablets of Ferrous Sulphate, Compound**
Content of ferrous sulphate. Amend to: 0·16 g. to 0·18 g.

CORRIGENDA

p. 175 **Chlorothiazide**
Empirical formula. Amend to $C_7H_6O_4N_3S_2Cl$ = 295·7.
Assay. Amend factor to 0·02957.

p. 1016 **Liniment of Camphor, Ammoniated**
Formula. In *Imperial* column, amend: 1¼ fl. oz. to 1½ oz.

p. 1022 **Lozenges of Benzalkonium**
Formula. Delete acacia and sucrose.
Insert after method of preparation: Each lozenge should weigh about 1 g.

p. 1215 **Appendix X**
Insert at end of items in the Table:

Tolbutamide	1	0·3 g.	7·7 ml.

CHANGES CONSEQUENT UPON THE PUBLICATION OF THE ADDENDUM 1960 TO THE BRITISH PHARMACOPŒIA 1958

The Addendum 1960 to the British Pharmacopœia 1958 becomes effective from March 1, 1961, and from that date the standards given in the British Pharmaceutical Codex 1959 will no longer apply to the following substances and preparations, which must then comply with the requirements of the B.P.

Amylobarbitone Sodium
Injection of Amylobarbitone Sodium
Tablets of Amylobarbitone Sodium
Bemegride
Busulphan
Chlorhexidine Gluconate Solution
Chlorhexidine Hydrochloride
Chlorothiazide
Diphtheria and Tetanus Vaccine
Halothane
Mercaptopurine
Naphazoline Hydrochloride
Phytomenadione
Piperazine Citrate
Poliomyelitis Vaccine
Pyridostigmine Bromide
Tolbutamide

The following amendments should be made to statements in the British Pharmaceutical Codex 1959. (The Addendum should be consulted for amendments to doses and detailed changes to standards in the British Pharmacopœia.)

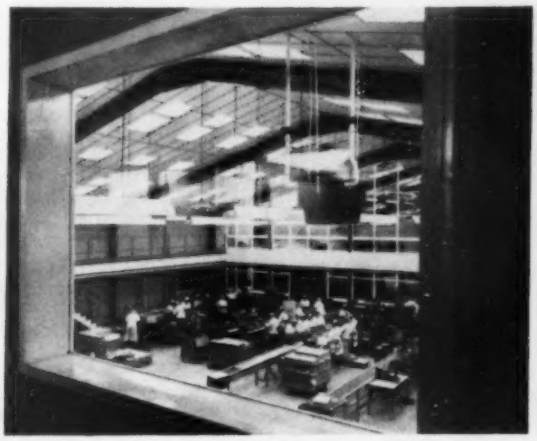
p. 214 **Corticotrophin Injection**
It should be used immediately after preparation.

p. 489 **Neomycin Sulphate**
The synonym "Neomycin" is deleted. Neomycin Sulphate contains not less than 600 units per mg., calculated with reference to the dried substance.

p. 562 **Phenoxymethylpenicillin Tablets**
Unless otherwise specified, tablets each containing 125 milligrams of phenoxymethylpenicillin or an equivalent amount of phenoxymethylpenicillin calcium or phenoxymethylpenicillin potassium will be supplied.

p. 760 **Suramin**
It contains not less than 97·5% of $C_{51}H_{34}O_{23}N_6S_6Na_6$, calculated with reference to the anhydrous substance. The water content is not more than 10% w/w.

p. 762 **Suxamethonium Chloride**
It contains not less than 98% and not more than the equivalent of 101% of



TWO NEW FACTORIES

Left: *Jeyes Sanitary Compounds Ltd. recently completed this new building as an addition to their Plaistow works. It houses laboratories, offices and the canteen. Building and equipment cost approximately £80,000.* Right: *Windows in the main office corridor at Bristol-Myers' new factory at Ruislip, Middlesex, give this view of the factory floor. The company is now handling its own sales instead of selling through agents. The new sales force of 15 "reps" is being trained under the supervision of Mr. Hare, managing director.*

$C_{14}H_{28}O_4N_2Cl_2$, calculated with reference to the anhydrous substance. The water content is 8% to 10% w/w.

p. 850 **Pertussis Vaccine** (third paragraph)
Pertussis Vaccine has an immunising potency at least equal to that of the Standard Preparation of pertussis vaccine reconstituted to contain 20,000 million organisms per ml., when assayed in mice.

p. 860 **Smallpox Vaccine**
Cultures of suitable tissue may be used as a source of vaccinal material. The tests for absence of *Bacillus anthracis, Clostridium tetani* and β-hæmolytic streptococci are replaced by tests for absence of aerobic pathogenic organisms and anaerobic pathogenic organisms.

Ethoheptazine off Poisons List

Pending consideration by the Poisons Board of representations that have been received, ethoheptazine and its salts will not be added to the Poisons List as was announced in the Home Office Notice of November 22, 1960.

Statutory Instruments will be introduced soon giving effect to the other changes in the Poisons List and Rules announced in the Notices of July 20 1960, and November 22, 1960.

Works managers to confer

The Institution of Works Managers will celebrate its 30th anniversary with a conference at Bournemouth, 21-23 April, to discuss international aspects of works management.

Among the British speakers will be Sir William Garrett of the British Employers Confederation (a former director of Monsanto Chemicals) and Mr. W. J. Carron, chairman of the British Productivity Council.

Attendance at the Conference is not restricted to members of the Institution. Intending visitors should write to the General Secretary, Institution of Works Managers, 196 Shaftesbury Avenue, London, W.C.2.

Predictions for 1961

According to a *Daily Express* survey, during 1961 the average person will get £1 12s. worth of N.H.S. prescriptions and will spend £1 on patent medicines. "Those with teeth will buy 4½ tubes of toothpaste, each man will spend 10s. on cosmetics, shaving lotions, deodorants and toilet water, and each woman will spend £3 10s. at the hairdresser's." A prediction for the veterinary market is that there will be 17 million dogs, cats and cage birds in Britain in 1961—a pet for every household.

Gerhardt-Penick Ltd.

C. F. Gerhardt Ltd., Huffer and Smith Ltd., and S.B. Penick and Co. Ltd. have been consolidated and are now known as Gerhardt-Penick Ltd. The new company will carry on all the activities of the three former firms including acting as sole agents for S. B. Penick and Co. New York, U.S.A.; Fine Chemicals of Canada Ltd., Toronto, Canada; and Siegfried Ltd., Zofingen, Switzerland.

The company has built new offices at Thornton Laboratories and have acquired an additional factory, Howe Laboratories, Canterbury Rd., Croydon. The directors of the new company are R. G. Archer (managing), A. D. Penick (U.S.A.) and W. J. D. Gardner.

Reorganisation of technical education

A major reorganisation of the system of courses for technicians, craftsmen and operatives in technical colleges is proposed in a new White Paper, "Better Opportunities in Technical Education."

The changes proposed have four main objects. These are to broaden the education received, follow more closely the needs of industry, increase the variety of courses, and reduce wastage due to failure to complete courses.

Information for exporters

A second edition of the coloured wall map, "Information for the British Exporter," has been prepared for the Board of Trade by the Central Office of Information.

The map pinpoints every U.K. commercial post throughout the world, gives U.K. export and import figures for many individual countries and the proportion of the U.K. contribution to their total imports. The sterling, dollar, E.F.T.A. and O.E.E.C. areas are indicated by different colours and national currency units and values are given.

The map, which is 40 in. wide by 30 in. deep, can be obtained free from the Regional Controllers of the Board of Trade. (See *Board of Trade Journal*, November 18, 1960, page 1258, for addresses.)

British industry in India

Over 1,500 British firms interested in the Indian market have been invited by the Board of Trade to join in the British display at the second Indian Industries Fair, Delhi, from November 4 to December 21 1961. Other countries exhibiting include Russia, America and Germany.

Electrical convention

"Electricity in the Prosperity and Welfare of the Nation" is to be the theme of the thirteenth British Electrical Power Convention which is to be held at Eastbourne from June 12 to 15, under the Presidency of Sir John Pickles, chairman of the South of Scotland Electricity Board.

Meetings

Royal Institute of Chemistry

March 15. Symposium: "The soil: problems raised by its use and misuse." 2 p.m. William Beveridge Hall, Senate House, London, W.C.1.

March 20. "The chemistry of fluorine," by R. N. Hazeldine. 6.30 p.m. County Technical College, Reigate Road, Ewell.

March 29. "Detergents," by K. G. A. Pankhurst. 7.30 p.m. Hendon Technical College.

The Chemical Society

March 9. "The electronic orbitals, shapes and spectra of simple molecules," by A. D. Walsh. 4.30 p.m. Chemistry Department, Sheffield University.

March 10. "Very fast chemical reactions," by G. Porter. 4.30 p.m. Chemistry Department, Birmingham University.

March 10. "Some aspects of the radiation chemistry of aqueous systems," by J. Weiss. 8.30 p.m. University Chemical Laboratory, Lensfield Road, Cambridge.

March 10. "Spectra of gases and vapours under high-frequency excitation," by C. L. Wilson. 5 p.m. Washington Singer Laboratories, Exeter University.

March 10. "Some reflections on the detergent industry," by A. Koebner. 5.30 p.m. Chemistry Department, King's College, Newcastle upon Tyne.

March 13. "Some aspects of the chemistry of the sesquiterpenes," by W. Cocker. 5.30 p.m. Chemistry Department, University College, Cathays Park, Cardiff.

March 13. "Aromatic fluorocarbons," by M. Stacey. 5 p.m. Science Laboratories, Durham University.

March 13. "Some polysaccharides of the human body," by A. B. Foster. 7 p.m. College of Technology, Portsmouth.

March 13. "Development of modern gas kinetics," by A. F. Trotman-Dickenson. 4.30 p.m. Chemistry Department, University College, Swansea.

March 15. "The Lurgi pressure gasification process," by D. C. Elgin and J. Linton. 8 p.m. University Chemistry Department, Old Aberdeen.

March 16. "Charge transfer in organic solids, induced by light," by A. N. Terenin. 7.30 p.m. Rooms of the Society, Burlington House, London, W.1.

March 16. "Cyclobutadiene—a success story," by J. F. W. McOmie. 5 p.m. Edward Davies Chemical Laboratories, University College, Aberystwyth.

March 16. "Some recent developments in agricultural chemistry," by R. L. Wain. 4.30 p.m. Chemistry Department, Sheffield University.

March 21. "Biosynthetic routes to phenolic compounds," by A. J. Birch. 4.30 p.m. Chemistry Department, University College, Swansea.

March 24. Symposium: "Organic intermediates in the 1960's." 10.30 a.m. Large Lecture Theatre, Chemistry Department, Manchester University.

Society of Chemical Industry

March 14. "Production of hydrogen from oil," by H. G. Klinkert. 6 p.m. 14 Belgrave Square, London, S.W.1.

March 16. "Tonnage oxygen production," by P. M. Shuftan. 6.30 p.m. Stephenson Building, King's College, Newcastle upon Tyne.

March 17. "Forensic science," by F. D. M. Hocking. A.G.M. Washington Singer Laboratories, Exeter University. 4.30 p.m.

March 17. "New horizons in polymer science," by C. E. H. Bawn. 8 p.m. Windscale Club, Seascale.

March 17. "The use of nuclear magnetic resonance in the determination of chemical structure," by L. M. Jackman. 6.30 p.m. 14 Belgrave Square, London, S.W.1.

March 21. "Aldehyde polymers," by J. C. Bevington. 6.30 p.m. Birmingham and Midland Institute, Birmingham.

March 20 and 21. Symposium: "Fungicides in agriculture and horticulture." 14 Belgrave Square, London, S.W.1.

March 22. "Case histories from a petroleum product development and technical service laboratory," by H. Russell. 5.30 p.m. Chemistry Department, Trinity College, Dublin.

March 23. Conversazione—Microbiological apparatus and methods. 4–8 p.m. Queen Elizabeth College, Campden Hill Road, London, W.8.

March 24. Fine Chemicals Group Conversazione. 6.30 p.m. 14 Belgrave Square, London, S.W.1.

March 24. Joint meeting with R.I.C. Paper by E. M. Evans. 7 p.m. College of Technology, Newport, Mon.

March 24. Symposium: "Organic intermediates in the 1960's." Four lectures including "Recent developments in aromatic oxidations," by P. E. Newman, "Intermediates for the dyestuffs and allied industries," by D. A. W. Adams, "The British chemical industry—from K.I.D. to Outer Seven," by G. Brearley. 10.30 a.m. Main Chemistry Theatre, Manchester University.

March 28. Works visit, Northern Aluminium Co. 12–1.30 p.m. Laboratory visit, Aluminium Laboratories Ltd., Banbury. 2.30–3.45 p.m. "The resistance of aluminium to supply waters," by H. P. Godard, "Behaviour of aluminium in modern power station condensate water," by E. A. G. Croom and D. Hastings. Crown Hotel, Banbury. 4 p.m.

March 30. A.G.M. "Laboratory design and equipment," by A. M. Smith. 7.30 p.m. North British Hotel, Princes Street, Edinburgh.

April 6. "Recent developments in Delrin," by G. F. C. Barrett. 7.30 p.m. The University, Southampton.

April 7. "2,6 - dichloro - 4 - nitro - aniline; a new fungicide for the control of botrytis," by D. J. Higgons. A.G.M. 6 p.m. Robinson Lecture Theatre, Manchester University.

Fertiliser Society

March 23. "Developments in phosphoric acid manufacture," by W. C. Weber and F. W. Edwards. 2.30 p.m. Geological Society Lecture Hall, Burlington House, London, W.1.

Society for Analytical Chemistry

March 10. "Vapour Phase Chromatography," by A. Verdin. Swansea.

March 23. "Measurement of *p*H and electrode potential for analytical purposes," by G. Mattock. 7 p.m. Nottingham Technical College.

March 24. "Non-aqueous titrimetry," by R. A. Wells and V. E. Gripp. Royal College of Science and Technology, Glasgow, C.1.

March 25. "The analysis of intact samples." 2.15 p.m. City Laboratories, Mount Pleasant, Liverpool.

March 29. Demonstration meeting of laboratory built equipment. Chelsea College of Science and Technology, Manresa Road, London, S.W.3.

Institution of Chemical Engineers

March 14. "Temperature control of exothermic reactions entailing special heat transfer problems," by B. F. Street. 6.30 p.m. Chemical Engineering Lecture Theatre, Manchester College of Science and Technology, Jackson Street, Manchester.

March 21. "Some factors in the safe operation of air separation plants." Discussion meeting. 5.30 p.m. Geological Society, Burlington House, London, W.1.

The Faraday Society

March 28. "Mechanisms of the gas-phase reactions of the halogens and their compounds—A. Oxidation processes, B. Reactions of elementary halogens." Chemistry Department, University College, Cardiff.

Pharmaceutical Society of Great Britain

March 23. "Pharmaceutical wholesaling today," by G. G. Hammond. 7.30 p.m. The Society's House, 17 Bloomsbury Square, London, W.C.1.

Cough relief

A new flavoured cough syrup, *Tecal-Drine*, is being marketed by Abbott Laboratories Ltd. It contains expectorants to liquefy thick tenacious sputum and an agent which lessens the discomfort of a reiterative cough by slowing the cough reflex. An antihistamine is included to control further respiratory irritation due to allergens.

The compound contains:

Thenylene (methapyrilene hcl., Abbott)	50 mg.
Dextromethorphan hydrobromide	30 mg.
Ammonium chloride B.P. ..	250 mg.
Ipecac liq. extract B.P.	0·5 m.
Menthol B.P.	$\frac{1}{6}$ gr.
Syrup B.P.	24·5 g.

Dosage varies from 1-2 teaspoonfuls every 4 hr. for adults to half this dose for children.

Pyridine anthelmintic

A new anthelmintic which is reported to be more active against nematodes in mice than phenothiazine or a mixture of bephenium embonate and hydroxy naphthoate, both of which are used in practice, has been developed by the Pharmaceuticals Division of I.C.I. It is 2 - (β - methoxyethyl) - pyridine (U.K. pat. appn. 40845/59; 40931/59; 20099/60). In *Nature* (1961 (4758), 59) Broome and Greenhalgh state that the feature which makes the new anthelmintic unique is that it is more active administered subcutaneously than orally. It is excreted in the alimentary canal, seemingly along the whole length, and possibly this allows more intimate contact with all worm species, whatever their location.

The compound was made by the Midland Tar Distillers and tested by I.C.I. Pharmaceuticals. It is being made available by I.C.I. under the name *Promintic*.

"Automatic" mascara

Coty have introduced *Coty-Matic* automatic roll-on mascara. Its refill system is an interchangeable cartridge that is quick and clean. When the mascara in the Coty-Matic is used up, the empty cartridge is quickly unscrewed and replaced by a full one. Colours are black, brown, blue, green, and charcoal. Price is 10s. 6d. Refill cartridges cost 8s. 9d. each.

Phenothiazine tranquilliser

A new phenothiazine derivative, Fluphenazine, (4 - (3 - [(2 - trifluoromethyl) - 10 - phenothiazinyl]propyl) - 1-piperazineethanol), has been developed by the Squibb Institute in New Brunswick, U.S.A. This substance, known as Moditen, has both tranquillising and anti-emetic properties and is claimed not to interfere with the consciousness of the ambulant patient. Side-effects are rarely produced with the daily dosage of 1 mg., it is stated.

It should not be used on patients receiving large doses of hypnotics. The 1 mg. tablets are supplied in bottles of 25.

Two from MSD

Merck Sharp and Dohme Ltd. have introduced two new products.

Striatran (generic name Emylcamate) is a tranquilliser and muscle-relaxant for use in psychosomatic and psychoneurotic disorders. Issued as 200 mg. tablets. (Schedule 4B.) The trade price is 10s. plus 5s. P.T. for 100 tablets.

Cremostrep (Succinylsulphathiazole [*Sulfasuxidine*] Streptomycin and kaolin) is an oral preparation for rapid control of diarrhœa. Issued in bottles of 3 fl. oz. (Schedule 4B.) The trade price is 6s. 6d., no P.T.

Angina prophylaxis

William R. Warner and Co. Ltd. have marketed a further form of Peritrate (pentaerythritol tetranitrate) named Peritrate *Sustained Action*.

This two-layered tablet contains an immediate release portion of 20 mg. of PETN, and a further 60 mg., which is released over 12 hr., giving prophylactic treatment for angina all round the clock.

Packs of 50 and 500 cost 10s. 4d. and 60s. respectively, no P.T.

Germicidal detergent

Siposan is a new ampholytic surface-active agent, exhibiting both anionic and cationic effects, thus combining certain characteristics of soap and of quaternary ammonium compounds.

The material contains about 50% of the ammonium salt of *n*-lauryl tetraethoxy amino sulphonic acid, which is the active ingredient. It is a clear amber-coloured liquid and remains a clear liquid even at the lowest temperatures. It is soluble in water, alcohol and most solvents.

The substance is claimed to be a powerful bactericide which is highly active against many pathogenic organisms, both Gram positive and Gram negative. It is active in the presence of organic matter (10% serum) and in both acid and alkaline conditions. *Siposan* retains restricted bactericidal activity at very low concentrations in the presence of soaps, anionic surface-active agents, protein, calcium, magnesium, ferrous and ferric ions.

According to the manufacturers, Sipon Products, Ltd., it is not toxic or irritating to the skin at the recommended concentrations. It has good wetting powers, thus ensuring penetration when used as a germicide, and foams rapidly.

Siposan is recommended for use primarily as a germicide-detergent for medicinal and hospital disinfection of surgical and dental instruments and utensils, for general purposes in dairies, restaurant, breweries, hospitals and households, medicated shampoos, cosmetics, etc.

It is supplied in 1, 4 and 5 gal. lacquer lined non-returnable cans and Epikote lined returnable 40 gal. drums.

Cool-water wash for woollens

A new cool-water shampoo, *Adamite* specially made for washing fine knitwear, is being produced by Mayborn Products Ltd. It is claimed to be effective even in hard water, and is as harmless to the skin as a superfatted soap. One heaped teaspoon of Adamite dissolved in 4 pts. of cool water will handle two or three garments.

It is sold in 6d. sachets and 3s. drums.

Low-cost corticosteroid

Glaxo Laboratories Ltd. have introduced a new corticosteroid, *Betnelan* (betamethasone) — 16β - methyl - 9α - fluoro-prednisolone. It is claimed that it has a higher potency and a greater anti-inflammatory effect than existing steroids. This enables it to be prescribed in smaller doses and diminishes the risk of side effects. Tests have shown that the compound is devoid of salt-retention activity (thus eliminating the risk of oedema), has negligible effect on potassium balance and causes no mental depression or muscle weakening.

The marketing of this steroid is noteworthy in that it is being offered at a lower price dose-for-dose than any existing cortisone derivative. Retail prices are: bottle of 30 tablets, 10s. 6d.; 100, 30s.; 500, 140s.

Cationic chemicals

Armour Hess Chemicals Ltd. have introduced a new range of cationic chemicals, the Propomeens. They are propylene oxide adducts of the Armeens (fatty amines), containing a minimum of 95% tertiary amine.

They are insoluble in water, but soluble in polar and non-polar organic solvents. Being difunctional alcohols they will undergo normal glycol and alcohol reactions. The quaternary ammonium salts formed by neutralising the Propomeens with inorganic acids or low molecular weight organic acids are surface-active and are soluble in water and alcohols.

Suggested uses for the Propomeens and their derivatives are as chemical intermediates, surface-active agents, biocides, corrosion inhibitors, demulsifiers, defoaming agents, viscose additives, etc.

News from Abroad

RUSSIA

Anti-coagulant

Addressing the Therapy Institute in Moscow recently, Dr. Evgeny Chazov said that vascular thrombosis could be treated with Fibrinolisin, a new preparation made at Moscow University.

Introduced into blood, Fibrinolisin helped to disperse experimentally induced clots. In nearly all cases the circulation of experimental animals was fully restored.

UNITED STATES

Dow acquires Allied Laboratories

Allied Laboratories Inc., manufacturers of pharmaceutical and biological products used for prevention and treatment of human and animal diseases, is now a part of Dow Chemicals. Shareholders of Allied voted to dissolve the firm as the final step in the plan by which Dow acquires Allied's assets in exchange for Dow stock.

Chemical combats CO_2 poisoning

The hazard of CO_2 poisoning, faced by people working in confined places, may be overcome by the use of drug injections. It may even be possible to develop oral drugs for the purpose. This was reported by Dr. G. G. Nahas before a conference of the New York Academy of Sciences on amine buffers.

The amine reported is tris (hydroxymethyl)-aminomethane, called THAM, or Tris buffer. It effectively protects dogs against what would be lethal levels of CO_2 in their blood.

Gastrointestinal tissues vary from alkaline to acid, and this circumstance is one reason no oral equivalent of THAM has yet been developed, since the acidity or alkalinity of a substance determines its ability to pass through the wall of a cell.

In the meantime, as Dr. Nahas pointed out in another paper, THAM already has been used successfully in aspirin poisoning.

THAM has also been found to be of use in bronchoscopy and this was reported in a paper by Dr. M. H. Holmdahl. During the operation, breathing is interfered with and there is increased retention of carbon dioxide by the patient.

THAM was infused into patients' veins in a 0·2% salt solution. The injection bound the CO_2 and produced no apparent ill effect.

The amine buffer also appeared to prevent the rise in blood pressure usually seen in patients who have had bronchial surgery, and it eliminated the sudden and marked rise in cerebrospinal fluid pressure expected in such cases.

Measuring enzyme activity

A new procedure for measuring the activities of enzymes was introduced at the annual meeting of the American Association for the Advancement of Science.

The method depends on physical measurement rather than analysis. A new product called *Thiogel*, a thiolated gelatine, is used. It can be cross-linked with a mild oxidant to form rigid gels that will not dissolve even in boiling water.

These gels can be attacked by any proteolytic enzyme that can hydrolyse gelatine. But cross-linked *Thiogel* gels cannot be penetrated by the enzyme and hydrolysis is restricted to the surface. Because the lysis products are soluble, the gel slowly melts away like an ice cube in water.

This means that the cube remains a cube throughout dissolution and the lengths of all edges of the cube decrease at an equal and constant rate. The rate of change of the length of an edge depends on the activity of the enzyme. Therefore, enzyme activities can be determined by simple linear measurements.

Flameproof rubber

A new flameproof rubber which also extinguishes flame was described at a recent meeting of the American Chemical Society.

The material, nitroso rubber, is resistant to solvents and a variety of strong chemicals, remains flexible and usable at very cold temperatures, and stands up to sunlight and ozone. The rubber is composed of carbon, oxygen and nitrogen. Unlike other rubbers, it contains no hydrogen.

Ban on red dye partially lifted

The Deputy Commissioner of Food and Drugs has signed an order permitting the use in externally applied drugs and cosmetics of the colour formerly known as FD&C Red No. 1, a water soluble coal-tar colour. For this use it will be designated as External D & C No. 15.

The action modifies an order of November 26, 1960, eliminating all use of FD&C Red No. 1 because preliminary experiments showed that it produces liver damage in test animals. F.D.A. immediately discontinued certification of any further batches of this colour—then widely used in a variety of foods as well as drugs and cosmetics, but not in lipsticks—and cancelled outstanding certificates for all previously certified lots.

Subsequently, the Toilet Goods Association and others petitioned for provisionally relisting of this colour for use in externally applied drugs and cosmetics. The F.D.A. now state that "the protection of the public health does not require the continued prohibition against using this colour additive in externally applied drugs and cosmetics."

Feeding studies are being continued to resolve the question of whether the colour may cause cancer. However, the F.D.A. said this is not a problem with the external use of the colour.

SWITZERLAND

Ciba's acquisition

Ciba Ltd has acquired a majority interest in the photochemical firm of Tellko, of Fribourg. Ciba's interests in photochemistry and related fields include the Eidophor large-screen colour projection system.

SOUTH AFRICA

Salt industry planned

Mr. T. W. Miller and his son, of Keimouth, about 60 miles from East London, hope to develop a salt industry along the lines of the established salt flats in the Port Elizabeth-Zwartkops area. About 500 acres of mud flats at the estuary of the Kei river will be utilised for recovery of salt by solar evaporation. The area has a potential production of about 50,000 tons of salt p.a. This is about seven times the amount at present consumed in East London.

Soap industry reports

Production of soap was normal in the last quarter of 1960 and during the first few weeks of 1961. Turnovers are showing an upward trend. Prices of tallow and coconut oil increased slightly in the latter months of 1960. Production throughout the year was maintained at normal levels. Apart from difficulty experienced at the beginning of last year in obtaining supplies of resin from China, raw material supplies are satisfactory.

Surgical dressings factory

South Africa's first surgical dressings factory has been erected at a cost of some £500,000 at Pinetown, near Durban. Products will include ordinary white bandages, surgical gauze, lint and miscellaneous surgical textiles, all of which have at present to be imported. In future, hundreds of thousands of pounds' worth of such textiles will be spun and woven each year at the factory from South African raw cotton.

Technicians have been sent from Britain to train local staff in the intricate

processes involved. The factory site is one of the largest levelled areas in Natal, and is planned to give an ultimate factory area of 250,000 sq. ft.

More than £10,000 was spent on site levelling alone. The latest prefabricated techniques have been employed. The vermiculite-insulated Q-deck roof is supported by pre-stressed concrete beams. Humidity and temperature in all process areas of the factory are controlled by air conditioning, and mechanical ventilation is used elsewhere.

INDIA

U.K. plant for dyestuffs factory

A contract worth about £1,300,000 for the design and construction of a chemical plant has been placed with Humphreys and Glasgow Ltd. The plant is to be built at Bulsar, 120 miles from Bombay, for Atul Products Ltd., an Indian company, and is an extension to existing plant.

It will produce dyestuff intermediates from naphthalene. The manufacturing programme includes 24 different products, but the plant will have a standard range of reaction vessels which will allow for variations to be made in the programme.

Full use of equipment manufactured in India will be made so as to conform with the current regulations of the Indian government. The design work on the plant will begin this year and it is expected to be complete in 1963.

WEST GERMANY

Hüls invests 85m. marks

Investments in new plant at Chemische Werke Hüls in 1960 amounted to about DM85 million. Some of the work completed included a wet-phase carbon black production unit, automation of plasticiser production, pelleting of SK resin, hydrochloric acid production under pressure, expansion of morpholine production and of PVC paste output, and the extension of the pipeline system to Leverkusen.

Cosmetic congress programme

The German Society of Cosmetic Chemists will hold a congress at Konstanz from May 11-13, 1961, together with the Society of Æsthetic Medicine. Besides other lectures there will be papers on colouring matters, soaps, syndets and allergic tests.

The German Society of Cosmetic Chemists will also hold the following meetings:

March 11, at the Battelle-Institute Frankfurt: "The spray patterns of pressure packs," by Dipl.-Ing. Lessenich, and "The possibilities of the evaluation of the particle size of Aerosols," by Prof. Dr. Straubel.

April 15, in Hamburg: "Essential oils," by Dr. Thomas, "Dielectric and refractometric evaluations on fatty oils," by Dr. Ludde, and "Plastics as packaging material for cosmetic products," by Dr. Mohrberg.

ISRAEL

Alkaloid manufacture

"Plantex," a Rothschild enterprise which will produce alkaloids for the pharmaceutical industry, is reported by Barclays Bank D.C.O. from Israel to have opened at Nathanya. The plant was built in six months at a cost of $1 million.

AUSTRALIA

Resins-wax plant

The Hercules Powder Co. (Australia) Pty. Ltd. is to build a £1½ million plant at Springvale, Victoria, for the manufacture of resin derivatives and wax emulsions. It is expected to be in operation by October.

£50m. invested in drugs

At the annual meeting of the Australian Association of Ethical Pharmaceutical Manufacturers it was announced that its 58 members have a combined investment of some £50 million in land, plant and equipment, and their 10,000 employees receive around £10 million a year in salaries and wages.

Quadruple vaccine ready for use

First supplies of the new vaccine, Quadruple Antigen, are now ready for distribution. It is claimed to combine protection against whooping cough, diphtheria, tetanus and poliomyelitis.

The first batch of 200,000 vials of the vaccine was prepared at the Commonwealth Serum Laboratories, Melbourne. Hitherto Australian health authorities have inoculated separately against polio and relied on Triple Antigen injections for protection against the other three diseases.

Imports from Japan

In the past year Japan's shipments of chemicals to Australia were valued at £900,000. Paints and pigments landed from Japan were worth £200,000. Australia's exports of zinc, titanium and zirconium to Japan were valued at £1,300,000.

FRANCE

Boric acid plant

American Potash and Chemical Corp., an important producer of boron products, and Société d'Électrochimie d'Électrométallurgie et des Aciéries Électriques d'Ugine, are to form a company called *Seurobor* (Société Européenne du Bore) which will construct a new plant at Pierre Bénite near Lyons, France, to produce boric acid from imported mineral borates. This plant, which will be adjacent to the Ugine plant, will be operational during 1961, and will cost approximately $2 million. Ugine have been interested in the production of boron derivatives for several years and American Potash want a source of production near the Common Market and Europe.

Boric acid produced by Seurobor will be distributed throughout Europe by Borax and Chemicals Ltd., the sole European and U.K. selling agents.

THE TECHNICAL PRESS IN MARCH

Scaling-up Experimental Plant

A SPECIAL feature in **Chemical and Process Engineering** deals with plant scale-up. Two articles are included: "Scale-up for drying and filtration plant" and "Hydrocarbon synthesis." There is also a review on size reduction. The series on materials of construction for chemical plant continues with a description of the properties and uses of aluminium.

Dairy Engineering publishes an interesting article on agricultural and veterinary chemicals. This will deal with the problem of husk disease and warble fly, and also the use of pesticides on dairy crops.

Dye adherence to fabrics is discussed in **Fibres and Plastics.** Also included are articles on plastic-coated steels, and how to protect polythene from thermal degradation.

An interesting article in **Automation Progress** describes the use of X-ray methods in automatic analysis.

Petroleum reviews telecommunications in the oil industry. Besides a review of equipment, there are two articles: "Supervisory Wireless Control" dealing with pipeline product control, and "Oilfield Radio Communications."

The Oil and Colour Chemists' Association exhibition is previewed in **Paint Manufacture.** There is also an article on the use of glycerin in motor car paints.

Recent developments in the design and use of potentiostats are described in **Corrosion Technology.** Also in the electrical field is an article discussing electrical resistance techniques to detect and measure corrosion.

Articles in **World Crops** include: "By-Products of the Rice Industry," "Weed Control in Tea" and a special review of power farming.

The annual review of dairy products and the meat industry are published in **Food Manufacture.** A special feature describes industrial cooking.

THE CHEMICAL MARKET

FEW CHANGES IN PRICES

LONDON.—The market has remained stable this month. **Lithium salts** have been reduced considerably and **boric acid** and **borax** are down. **Gums** and **waxes** are steady, but **palm oil** and **palm kernel oil** have both risen considerably.

FINE CHEMICALS

Acetanilide 12½ kg. 7s. 4d. kg.
Arsenic trioxide
5 to 10-ton lots £37 ton
Ascorbic acid
100 kg. £3 6s. 6d. kg.
Aspirin
1-cwt. lots in bags 4s. 10d. „
5-cwt. 4s. 8d. „
Atropine
Sulphate, 500 g. £59 18s. 6d. kg.
Alkaloid, 500 g. £68 15s. kg.
Benzene B.P.C. 28-lb. lots 1s. 8d. lb.
Benzoic acid 12½ kg. 7s. 4d. kg.
Benzyl benzoate
1-cwt. lots 5s. lb.
Bismuth oxide B.P.C. 1934
28-lb. lots 26s. 10d. lb.
Bismuth salts 1-cwt. lots:
Carbonate 20s. lb.
Subgallate 19s. 3d. „
Salicylate 19s. 9d. „
Subnitrate 18s. „
Borax B.P.
Powder £60 ton
Extra fine £61 „
Boric acid B.P.
Crystal £98 10s. „
Powder £96 „
Bromine B.P.C. 7-lb. lots 6s. lb.
Caffeine 50 kg. 42s. 6d. kg.
Calamine 50 kg. 4s. kg.
Calcium gluconate
1-cwt. lots dlvd. 3s. 7d. lb.
Calcium glycerophosphate
50 kg. 28s. 6d. kg.
Calcium lactate B.P.
28-lb. lots 2s. 7d. lb.
1-cwt. lots 2s. 4d. „
Chloral hydrate 50 kg. 10s. kg.
Citric acid B.P. Powder or granulated:
1-4 cwt. lots in bags 193s. cwt.
5-19 cwt. lots „ „ 189s. „
Codeine
Alkaloid 100 g. £138 10s. kg.
Phosphate 100 g. £110 „
Cream of tartar
1-cwt. lots £12 5s. cwt.
5-cwt. lots £12 3s. „
Ephedrine
Hydrochloride 3 kg. £7 1s. 1d. kg.
Alkaloid 3 kg. £12 7s. „
Sulphate 3 kg. £7 1s. 1d. „
Eucalyptol
1-cwt. lots 11s. lb.
5-cwt. lots 10s. 6d. „
Ferri ammonium citrate B.P.
1-cwt. lots, scales 4s. 4½d. lb.
1-cwt. lots, granules 3s. 6½d. „
Ferrous gluconate B.P.
1-cwt. lots dlvd. 6s. 3d. lb.
Gallic acid B.P.C.
1-cwt. lots 10s. „
Gluconic acid technical 50%
Minimum 12-gal. drums
19s. gal., drums extra, returnable
Glucono delta lactone
1-ton lots dlvd. 5s. net lb.
Glycerophosphoric acid
24 litres 11s. 10d. litre
Glycine (amino acetic acid)
12½ kg. 18s. 10d. kg.
Hexyl resorcinol 10 kg. £7 10s. „
Hydroquinone 12½ kg. 23s. 10d. „
Iodides
Ethyl 4 kg. bottles 66s. kg.
Mercury, red B.P.C.
12½ kg. lots 58s. 6d. „
Potassium B.P.
12½ kg. lots 19s. 10d. „
Sodium B.P.
12½ kg. lots 24s. 9d. „
Iodine, Chilean crude,
99% min. in wooden casks 17s. 4d. kg.
Iodoform
12½ kg. and under 50 kg. 42s. 6d. kg.
Lactic acid
Edible, 50% by weight 1s. 4½d. lb.
Dark tech., 44% by weight 9d. „
Lactose 50 kg. 3s. 2d. kg.
Lithium salts
Benzoate (5-cwt. lots) 10s. lb.
Carbonate (7×325 lb.) 6s. „
Chloride (7×300 lb.) 9s. 3d. „
Hydroxide (7×325 lb.) 6s. 6d. „
Citrate B.P.C. 9s. „
Sulphate 8s. 6d. „
Salicylate, 10 cwt., dlvd. 9s. 9d. „
Magnesium carbonate B.P.
Light cwt. lots dlvd. £129 ton
Magnesium trisilicate 28-lb. packs
28-lb. lots 4s. 3d. lb.
1-cwt. lots 3s. 10d. „
5-cwt. lots 3s. 7d. „
Bulk rates for larger quantities are from 3s. 1d. lb. in 1-ton lots
Manganese hypophosphite B.P.C.
7-lb. lots 13s. 11d. lb.
1-cwt. lots 12s. 11d. „
Mercuric chloride B.P.
50-kg. lump 48s. 6d. kg.
Methyl salicylate 1-cwt. lots 3s. 3d. lb.
Morphine
Alkaloid, 100 g. £138 18s. 4d. kg.
Nicotinamide 1 kg. £2 10s. 6d. kg.
Nicotinic acid
12½ kg. 32s. 9d. kg
1 kg. 35s. „
Oleine B.P. extra pale, 3/4 cwt. drums returnable carriage paid G.B.
£160 ton
Phenolphthalein 50 kg. 24s. 3d. kg.
Phosphoric acid B.P.
(s.g. 1·750) 10-carboy lots 1s. 4d. lb.
Potassium permanganate B.P.
1-cwt. lots dlvd. 1s. 11¾d. lb.
Procaine hydrochloride (foreign)
2 kg. 59s. kg.
Quinine sulphate 100 oz. 2s. 9½d. oz.
Riboflavin
100 g. 5½d. g.
10 g. 7d. „
Saccharin
500 g. £7 4s. for this quantity
Salicylic acid B.P.
1-cwt. lots dlvd. 3s. 2½d. lb.
Silver nitrate
500 g. 5s. 2$\frac{15}{16}$d. oz.
Sodium benzoate B.P.
1-cwt. lots 2s. 9½d. lb.
1-ton lots 2s. 7½d. „
Sodium gluconate technical
3-cwt. lots dlvd. 3s. net lb.
Sodium salicylate
50 kg. 8s. 8d. kg.
12½ kg. 9s. „
Sodium thiosulphate
Crystals, photographic quality
1-ton lots 49s. cwt.
Stearic acid B.P.C. flake, carriage paid G.B. £154 ton
Strychnine 25 oz. and under.
Alkaloid 11s. 3d. oz.
Hydrochloride 11s. 3d. „
Sulphate 10s. 3d. „
Sulphaguanidine
12½ kg. 33s. kg.
50 kg. 32s. „
Sulphanilamide
12½ kg. 16s. 6d. kg.
50 kg. 15s. 4d. „
Sulphathiazole 12½ kg. 39s. 9d. „
Tannic acid B.P. Levis
1-cwt. lots 10s. lb.
Tartaric acid B.P.
Powder or granulated, in kegs.
1-ton lots 298s. cwt.
Terpineol B.P.
40-gal. drums 2s. 4½d. lb.
1-cwt. lots 2s. 7d. „
Theophylline B.P.
500 g. 27s. 6d. for this quantity
Thiamine hydrochloride
100 g. 3d. g.
1 kg. £9 5s. kg.
Thioglycollate
Ammonium 12s. 4d. to 16s. 4d. lb.
Calcium:
7-lb. lots 17s. 3d. „
5-cwt. lots 14s. 3d. „
α-Tocopherol 25-g. lots 11½d. g.
Vanillin 23s. 6d. lb.
Zinc oxide B.P.
2-ton lots dlvd. £107 10s. ton

GENERAL CHEMICALS

Acetic acid 500 gals. bulk dlvd. U.K.
80% Technical £81 ton
80% Pure £87 „
Glacial B.P. £101 „
98-100% Glacial £97 „

Acetic anhydride
1-ton lots dlvd. £128 ton
Acetone
5-gal. drums, free, non-returnable £124 ton
40 to 45-gal. drums, 10-ton lots and over £80 „
Alum, potassium granular crystals
50 kg. 1s. 2d. kg.
Aluminium hydroxide B.P.C. 34
28-lb. lots 2s. 4d. lb.
Aluminium stearate (Standard)
(Precipitate) 1-ton lots £233 10s. ton
Ammonia
Persulphate £6 13s. 6d. cwt.
Phosphate: Mono- £106 ton
Di- £97 10s. „
Amyl acetate
B.S.S. 10 tons and over £251 ton
Technical £249 „
Amyl alcohol
Technical in 1-ton lots £256 ton
Arsenic White powdered ex store £42 ton
***n*-Butyl acetate**
10-ton lots in drums £165 ton
***n*-Butyl alcohol**
10-ton lots in drums £137 10s. ton
Calcium chloride
Solid and Flake, dlvd. in 1-ton lots £16 10s. ton
Calcium oxide (Lime)
Ex marble 28-lb. lots 3s. 10d. lb.
Caustic soda
Solid in drums, dlvd. £37 16s. 6d. ton
Flake in drums, dlvd. £35 10s. 6d. ton
Chloroform B.P. ½-ton lots 2s. 11½d. lb.
Chromic acid
Dlvd. U.K. (less 2½%) 2s. 0½d. to 2s. 0¾d. lb.
DDT (Technical) 3s. lb.
2 : 4-Dichlorophenoxyacetic acid
99% pure, 1-cwt. bags £320 ton
Dimethyl sulphate
3-cwt. drums 1s. 11d. lb.
Ether (Diethyl ether)
Tech. B.S.S. and Solvent B.P.
1-ton lots in drums 2s. lb.
Ethyl acetate
10-ton lots in drums £137 ton
Ethyl alcohol
95% Gay Lussac 66·0 o.p.
over 300,000 proof gallons per year in tank wagons
3s. 2¾d. per proof gal.
Ferrous sulphate 50 kg. 1s. 4d. kg.
Formaldehyde
40% by volume dlvd. England
1-ton lots £37 5s. ton
Glycerin
1·2627 s.g. chem. pure, 5 tons and up, 5-cwt. drums £241 10s. ton
1·2627 s.g. technical grade, 5 tons and up, 5-cwt. drums £236 10s. ton
Hexamine
1-ton lots
Technical, bulk 1s. 7d. lb.
B.P.C. 1s. 10d. lb.
Hydrochloric acid
Commercial 18s. 6d. cwt.
Hydrogen peroxide 1-cwt. lots
27·5% weight £115 ton
35% weight £138 „
Lactic acid (1-ton lots)
Pale tech. 44% by weight 1s. 3¼d. lb.
Dark tech. 44% by weight 9¼d. lb.
Magnesium chloride
Solid (ex wharf): 1-ton lots £18 10s. ton
Magnesium sulphate £15 ton
Mercurous chloride (calomel)
50 kg. 65s. kg.
Mercury sulphide, r[illegible]
Ton lots and over 30s. 6d. lb.
Methylated spirits [illegible]rial)
Perfumery qualit[illegible] gal. and upwards: gal.
64 o.p. 7s. 4d.
74 o.p. 7s. 11d.
5 gal.:
64 o.p. 8s. 7½d.
74 o.p. 9s. 2½d.
Methyl ethyl ketone
10 tons dlvd. in drums £134 10s. ton
Methyl isobutyl carbinol
10 tons and up, in drums, dlvd. £159 ton
Naphthalene
Crystal, dlvd., 4-ton lots, spot £66 ton
Ball and flake (ditto) £86 15s. „
Nickel sulphate
dlvd. ton lots £189 ton
Nitric acid 70% intermediate £36 ton
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Dimethyl (B.S.) £194 ton
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Hydrated (1-ton lots) £74 „
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Dlvd. ton lots: Di-sodium, crystalline £40 10s. ton
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Tri-sodium, crystalline £39 „
Anhydrous £86 „
Sodium silicate according to grade
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(Salt cake) unground, full truck loads £8 16s. 6d. ton
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Stannous chloride 28-lb. lots 9s. 5d. lb.
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Composition for treatment of the skin. *A. A. Hellbaum.* 859,546.

Process for producing microbial metabolium products and derivatives thereof. *L. Merckle.* 859,748.

Process for the transformation of steroids. *Takeda Pharmaceutical Industries Ltd.* 859,694.

Process for preparing substituted tetracyclines. *Bristol-Myer's Co.* 859,394.

Manufacture of halogen-androstadienes. *Ciba Ltd.* 859,747.

Compositions for treatment of human skin. *K. Thomae G.m.b.H.* 859,552.

Tetra-iodophthalamic acids and their salts. *Glaxo Laboratories Ltd.* 859,818.

Pharmaceutical preparations. *H. Rabinovitch* 859,555.

Steroids

Dihalogen derivatives of steroids and methods for their production. *K. Abildgaard* [trading as *Lovens Kemiske Fabrik ved a Kongsted*]. 862,235.

Steroid compounds and the preparation thereof. *C. Pfizer & Co. Inc.* 862,370.

Process for preparing steroid compounds. *Merck and Co. Inc.* 862,383.

Phosphorus esters and process for their preparation. *Soc. des Usines Chimiques Rhône-Poulenc.* 854,351.

Pesticides

Organic dithiophosphoric compounds, their preparation and pesticidal compositions comprising same. *C. Pfizer and Co. Inc.* 861,860.

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Bayleys Chemists (Clacton) Ltd. 30.12.60. Granby Place, Granby Street, Leicester. £10,000. Dirs.: C. F. Bayley and A. M. Porter.

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A. E. Gray (Chemists) Ltd. 9.1.61. £100. Dirs.: not named. Subs.: D. M. Graeme, Fairview Ave, Gillingham, Kent, and C. Rhodes.

C. Fry's (Pharmacy) Ltd. 25.1.61. 137 Albert Road, Southsea, Hants. £3,000. Dirs.: C. and Mrs. P. Fry.

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Large and Baker Ltd. 27.1.61. 10 King Street, Thetford, Norfolk. Chemists, druggists, etc. £18,000. Dirs.: A. G. Large, J. C. Baker and P. A. H. Large.

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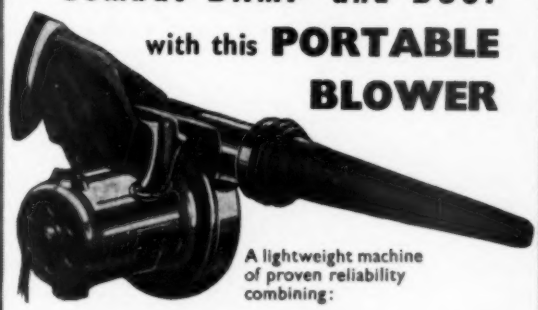

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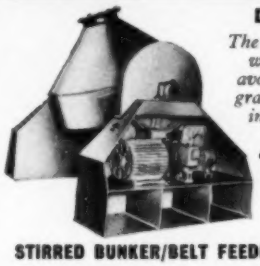

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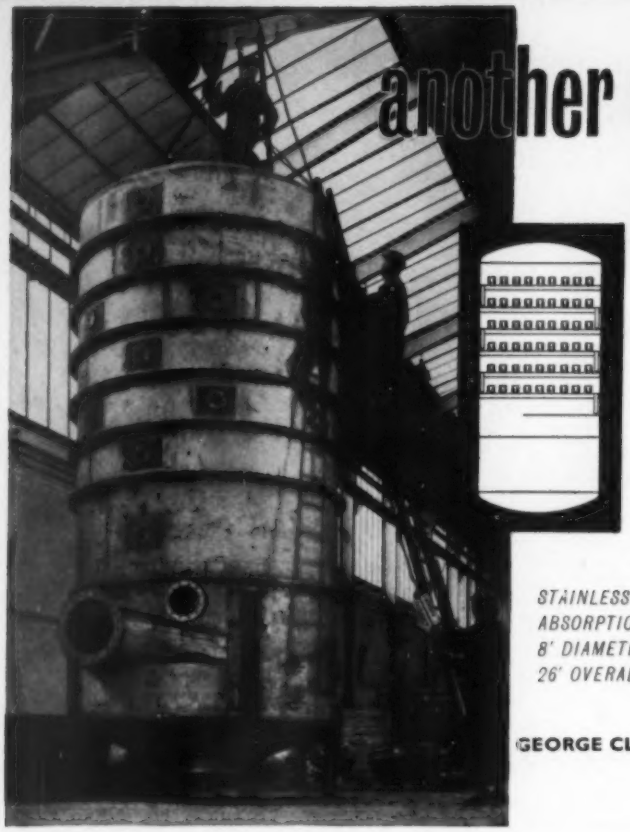

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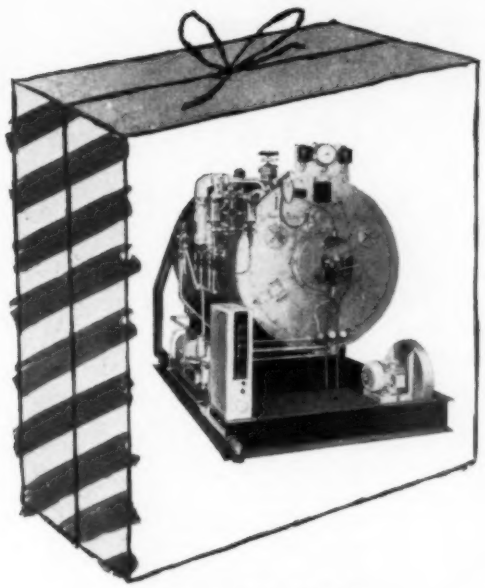

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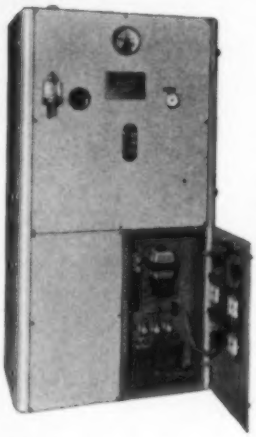

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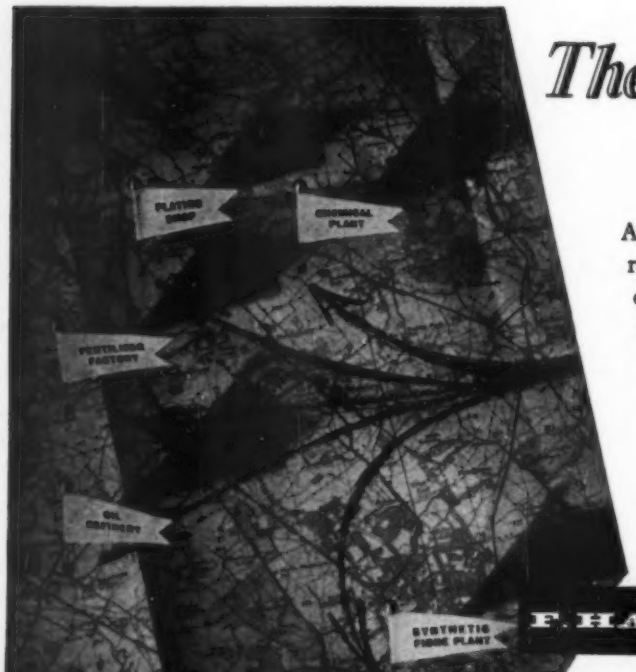

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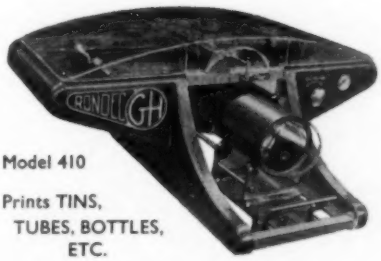

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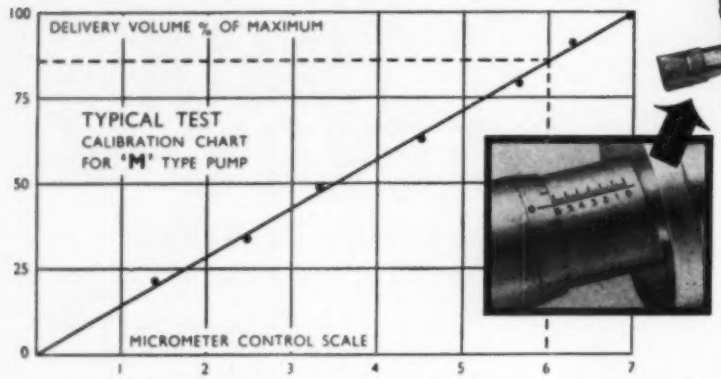

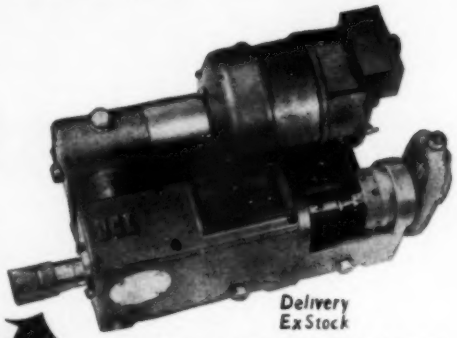

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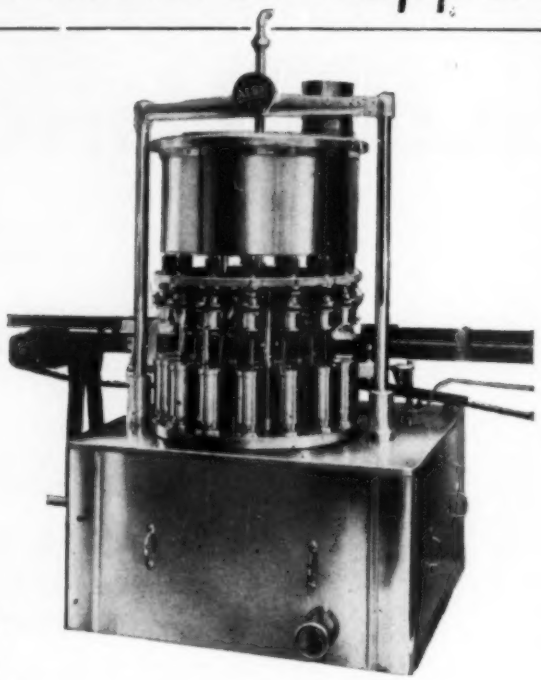

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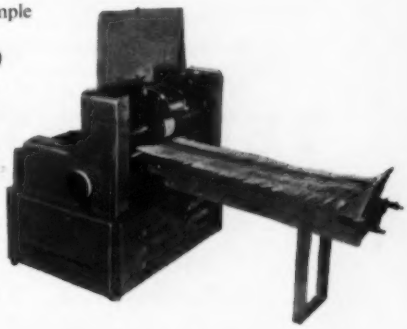

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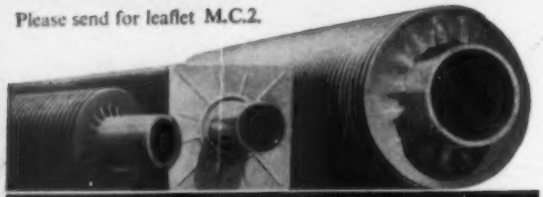

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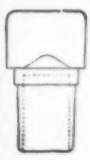

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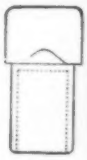

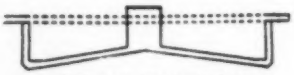

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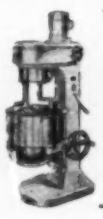

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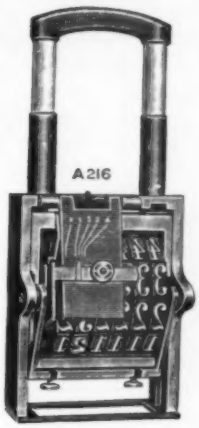

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Ref. B.41. British. Male. Single. Age 21. H.N.C. (Mech.). S.I. Mech.E. 4 years Grade "A" Indentured Apprentice & at present Fire Engine Design & Detail Draughtsman, commercial municipal & fire engine manufacturers. Seeks post as **MECHANICAL ENGINEER.** London or S.E. England. £725/£750 p.a.

Ref. B.42. British. Male. Married. Age 27. B.A. (Mech. Sciences). G. Inst. Welding. 1 year Student Apprentice, electrical engineers. 1½ years Computor, exploration geophysicists. 1½ years Management Trainee. 1 year Works Engineer & now Deputy Works Manager, engineers, fabricators by welding of plant for petroleum & chemical industries. Seeks post as **ADMINISTRATIVE ENGINEER.** New Zealand or S. Africa. £1,750 p.a.

Ref. B.43. British. Male. Married. Age 27. O.N.C. Chem. 1st Final C. & G. Paint Technology. 5 years Apprentice & 1 year Works Chemist, paint manufacturers. 3 years Development Chemist, paint & varnish manufacturer. At present Technical Service Chemist, pigments manufacturers. Seeks post as **TECHNICAL SALES REPRESENTATIVE PREFERABLY SELLING RESINS OR PIGMENTS TO SURFACE COATING & PLASTICS INDUSTRIES.** S. England or Midlands. £1,000 p.a.

Ref. B.44. British. Male. Married. Age 28. O.N.C. Mech. & studying for final H.N.C. Engg. Apprenticeship. 5 years Engineer, R.N. 2 years Draughtsman, chemical manufacturers. At present Design Draughtsman, chemical plant engineers. Seeks post as **ENGINEER (MECHANICAL).** London. £1,000 p.a.

Ref. B.45. British. Male. Married. Age 25. P.S.T. II. Workshop Courses I-IV, U.L.Cl. Full Technological Cert. 6 years Apprentice & 2½ years Skilled Production Work, aircraft. At present engaged in Production Work, aircraft manufacturer. Seeks post as **ENGINEERING REPRESENTATIVE OR PRODUCTION ENGINEER.** U.K. £850 p.a.

Ref. B.46. German. Male. Married. Resident U.K. Fluent English & German. 3½ years Apprentice, scientific instrument engineers. 1 year Prototype Engineer, optical instruments. At present Prototype Engineer, electronic instruments. Seeks post as **SALES OR SERVICE REPRESENTATIVE.** London—preferably S. London—£850 p.a.

Ref. B.48. Male. British. Married. Age 48. Royal Botanic Garden Cert. 3 years Apprentice, nursery & market gardeners. 5 years Student Gardener, botanic garden. 23½ years Farm Superintendent, banana, cocoa, oil palm growers in tropical American countries. Experience management large numbers farm workers, housing, labour disputes, crop & cash estimates, soil surveys for future plantings & supervision of planting & draining. Seeks post as **FARM SUPERINTENDENT OR MANAGER IN ANY TROPICAL COUNTRY**—preferably American Tropics. £1,800 p.a.

Ref. B.49. British. Male. Married. Age 35. B.Sc. (Physics & Maths). A.Inst.P. 1 year Research Physicist, optical company. 1 year Technical Officer, industrial chemicals. At present Lecturer in Physics. Local education authority, including arranging courses for local industries. Seeks post as **EDUCATION/TRAINING OFFICER.** N. England or Scotland. £1,600 p.a.

Ref. B.50. British. Male. Married. Age 30. Nat. Cert. Mech. Eng. H.N.C. Prod. Engg. A.M.I. Prod.E. 5 years General Engineering Apprenticeship. 1½ years Assistant to Production Manager, manufacturer of small tools. At present Assistant Production Manager, manufacturer of machine tools. Seeks post as **PRODUCTION MANAGER/CONTROLLER OR ASSISTANT WORKS MANAGER.** U.K. (not London), Australia, New Zealand or Canada. £1,400 p.a.

Ref. B.51. British. Male. Married. Age 31. H.N.C. Mech. 3 yrs. Apprentice. 2½ yrs. Wind Tunnel Technician & 7 yrs. Flight Test Engr., aircraft mnfr. At present Flight Test Engr., aircraft mnfr. Seeks post as **MECHANICAL ENGR.,** Commonwealth, Africa.

Ref. B.52. British. Male. Married. Age 26. B.Sc. (Eng.). G.I.Mech.E. Fluent French & Spanish. 1½ yrs. Graduate Apprentice, aero gas-turbine & marine diesel research design & mnfrs. At present Research Engr. (nuclear power), civil nuclear power generation. Seeks **INTERESTING POST—OF COMMERCIAL OPERATIONAL OR MANAGEMENT NATURE.** London, S. England, S. France or Spain. £1,300 p.a.

Ref. B.53. British. Male. Married. Age 35. B.Sc. (Eng.). A.M.I.Mech.E. 3½ yrs. Apprentice, paper mill mnfrs. 1½ yrs. Stress Calculator, aero engine mnfrs. At present Senr. Diesel Fuel Injection Research Engineer, diesel fuel injection equipt. mnfrs. Seeks post as **RESEARCH AND/OR DEVELOPMENT ENGR.** S. England. £1,500 p.a.

Ref. B.56. British. Male. Married. Age 32. H.N.C. Mech. & endorsement in Internal Combustion Engines. Application for Grad.I.Mech.Eng. submitted. 3 yrs. Turner & Fitter Trainee, automobile components. 6 mnths. Planning Engr., ceramic component mnfrs. At present Asst. to the Experimental Engr., devpt. of rocket engine components & test rigs, motive power unit mnfrs. Seeks post as **MECHANICAL ENGINEER (DEVPT. OR EXPERIMENTAL), PREF. CONNECTED WITH MOTIVE POWER UNITS & ACCESSORIES.** U.K.—not London—or Switzerland. £1,300 p.a.

Ref. B.57. British. Male. Single. Age 24. 1 yr. Engr., telephones. 1 yr. Electronic Engr., tape recorders. 2½ yrs. Radio, TV & Tape Engr. At present Radio & TV Engr., radio & TV retailer. Seeks post as **RADIO/TV ENGR.** (anything considered). Germany. £800 p.a.

Ref. B.58. Irish. Male. Single. Age 29. B.Sc. 2 yrs. Clerical work, genl. engg. 9 mnths. Physicist, steel mnfrs. 2 yrs. Devpt. Manager, margarine mnfr. At present Production Consultant, margarine mnfr. Seeks **PRODUCTION MANAGEMENT POST.** London, S. England, Ireland or America. £800 p.a. min.

Ref. B.59. British. Male. Married. Age 46. C.&G. 4 yrs. Devpt. Engr., jigs & fixtures, special purpose m/cy mnfrs. 6 yrs. Prod. Engr., govt. work. 11 yrs. from Prod. Engr. to Works Manager, razor products —incldg. plastic. 4 yrs. Works Manager, household appliances. At present Works Production Manager, laundry m/cy mnfrs. Exper. Drawing Office, Planning, Stock Control, Stores & Despatch, devpt. labour saving mechanisms. Seeks post as **MECHANICAL, PRODUCTION OR PLANNING ENGINEER.** U.K.—Provinces or Outer London.

Ref. B.60. British. Male. Married. Age 30. 2 yrs. Apprentice/Mechanic & Sales Representative, prod. of weighing machines & bacon slicers. 10 yrs. Sales & Service Representative, retail electrical domestic appliances (radio, TV & allied industries). Seeks post as **TECHNICAL REPRESENTATIVE,** U.K.—Midlands area, or New Zealand. £1,000 p.a. min.

Ref. B.62. British. Male. Married. Age 32. 2nd yr O.N.C. & all R.N. certs. for aircraft artificer. 5 yrs. i/c aircraft maintenance & 3 yrs. Workshop Instructor i/c fitter/Turning & lecturing on Workshop Practice, Fleet Air Arm. 2 yrs. Travelling Instructor, R.N. Engg. Publicity & at present Aircraft Engg. Instructor, Fleet Air Arm. Seeks post as **ENGINEERING INSTRUCTOR OR TECHNICAL SALES REPRESENTATIVE.** £1,000/£1,200 p.a.

Ref. B.63. British. Male. Married. Age 46. O.N.C. Engg. 5 yrs. Engg. Apprenticeship. 1 yr. Work Study Engr., handbag manfrs. 2 yrs. Prod. Manager & 4 yrs. Prod. Engr., launderers & dry cleaners. 2 yrs. Time & Motion study Expert, govt. work. 4 yrs. Senr. Work Study Engr., electrical engrs. At present Senr. Work Study Consultant, organisation & method, industrial & management consultants. Seeks post as **WORKS OR PRODUCTION MANAGER.** U.K.—London or S. Counties. £1,500 p.a.

Ref. B.64. British. Male. Single. Age 29. H.N.C. Mech. & Endorsements Structures, Industl. Admin. Workshop Eng. 2 yrs. Apprentice, press toolmakers. 2 yrs. Apprentice, research equipt. mnfr. 3 yrs. D/man/Methods Engr., carbide tool mnfrs. 2½ yrs. Devpt. Engr., cutlers. At present Development Engr., cutlers, flat & hollow-ware mnfrs. Seeks post as **SMALL TOOLS D/MAN OR GENERAL TECH. WORK.** U.K.—Midlands pref. £850 p.a.

Ref. B.65. British. Male. Married. Age 34. H.N.C. Mech. Eng. 6 yrs. Apprentice. 8 yrs. Junr. D/man & 6 mnths. D/man, crane makers & mech. handling engrs. 5 yrs. Senr. D/man & 2 yrs. Leading D/man, i/c Structural Design, quarry plant specialist, mech. handling & structural engrs. 1 yr. Senr. Designer (Structures), new devpt. dept. of steam & gas turbine mnfrs. At present Section Leader in large D/O (Senr. staff appointment), responsible for mech. & structural design with mech. handling engg. concern. Seeks post as **DEPUTY CHIEF OR CHIEF D/MAN PREF. WITH MEDIUM SIZE COMPANY.** U.K.—Provinces or Scotland pref.

Ref. B.66. British. Male. Married. Age 32. A.M.I. Gas.E. 10 yrs. Technical Assistant, gas mnfr. At present Assistant Station Engineer, administration, tech., & chem. control & labour control of small unit as well as prod. & maintenance, gas mnfr. Seeks Technical Post where exper. & knowledge could best be used. U.K.—pref. North Birmingham & Midlands, £1,200 p.a.

Ref. B.67. British. Male. Married. Age 35. H.N.C. Electrical Engg. (Electronics) with endorsements. Grad.I.E.E. 3 yrs. Instrument Assembler & 2½ yrs. Leading Hand on Assembly of Amplifiers & Control panels, mnfrs. of aircraft navigational instruments. 2½ yrs. Planning Engr., & 3½ yrs. Asst. Prod. Engr., mnfrs. auto pilots & aircraft flight systems. At present Asst. Prod. Engr., mnfrs. of aircraft & marine navigational instruments, auto pilots & aircraft flight systems. Seeks post as **PROD. ENGR. (LIGHT ELECTRO-MECH. ASSEMBLIES) OR ASST. WORKS MANAGER (WITH SMALL COMPANY MNFG. LIGHT ELECTRONIC & ELECTRO-MECH. EQUIPT.).** W. London area or nr. coast W. of Bournemouth. £1,150 p.a.

Ref. B.68. British. Male. Married. Age 33. H.N.C. Prod. Engg. & endorsements in Industrial Administration (Commercial & Tech.), Prod. Planning & Strength of Material. At present Jig & Tool Design D/man, jet engine design & mnfr. Seeks post as **SECTION LEADER OR SPECIAL PURPOSE MACHINE DESIGNER.** U.K.—not London—£1,250/£1,350 p.a.

Ref. B.69. British. Male. Married. Age 27. B.Eng., B.A. 6 mnths. Asst. Site Engr., civil engg. contractors. 1 yr. Design & Detail of Steel & R/C Structures, consulting engrs. 2 yrs. Site Engr., road & bridge works, civil engg. contractors. At present Designer—design of heavy structures—consulting engrs. In addition studied Town Planning & has exper. of prestressed concrete, steel piling, concrete piling & earthworks. Seeks post as **SECTION ENGINEER, ABROAD**—pref. Turkey, Greece, Spain, America, Pakistan or Jamaica. £1,800 p.a.

Ref. B.70. British. Male. Single. Age 38. Read (2 yrs.) for degree in Geology, with Physics & Maths. Govt. course in workshop practice. Fellow of Geological Soc. of London. 3 yrs. Learner. 2 yrs. Junr. Engr., & 1 yr. Engineer-Supervisor, water supply, drilling & prospecting engg., contractors. 12½ yrs. Director of drilling contracting company in Africa responsible for development & management. Consid. exper. diamond drilling for mineral prospecting, coal core drilling, construction & repair of water well installations with borehole pumps, storage tanks & distbtn. systems, & genl. administration. Fluent German. Seeks post as **ENGINEERING EXECUTIVE OR TECHNICAL REPRESENTATIVE OR SIMILAR.** London or London-based (prepared to travel anywhere). £1,000 p.a. min.

Ref. B.71. British. Male. Married. Age 29. D.L.C. (Eng.), Grad.I.Prod.E. 2 yrs. Post-Grad. Apprentice in prod. engg., aircraft & structural engrs. 3 yrs. Technical (Engineer) Branch, R.A.F. At present Senr. Production Devpt. Engr., medium mech./electrical engg. Tech. & Commercial Sales exper. Seeks post in **TECHNICAL SALES OR PUBLIC RELATIONS.** London or South or West England. £1,250 p.a.

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